

AUTOMOTIVE INDUSTRIES

LAND AIR WATER

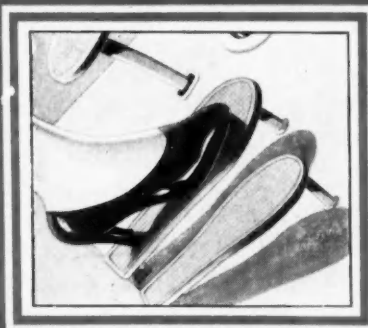
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foot accelerator..*



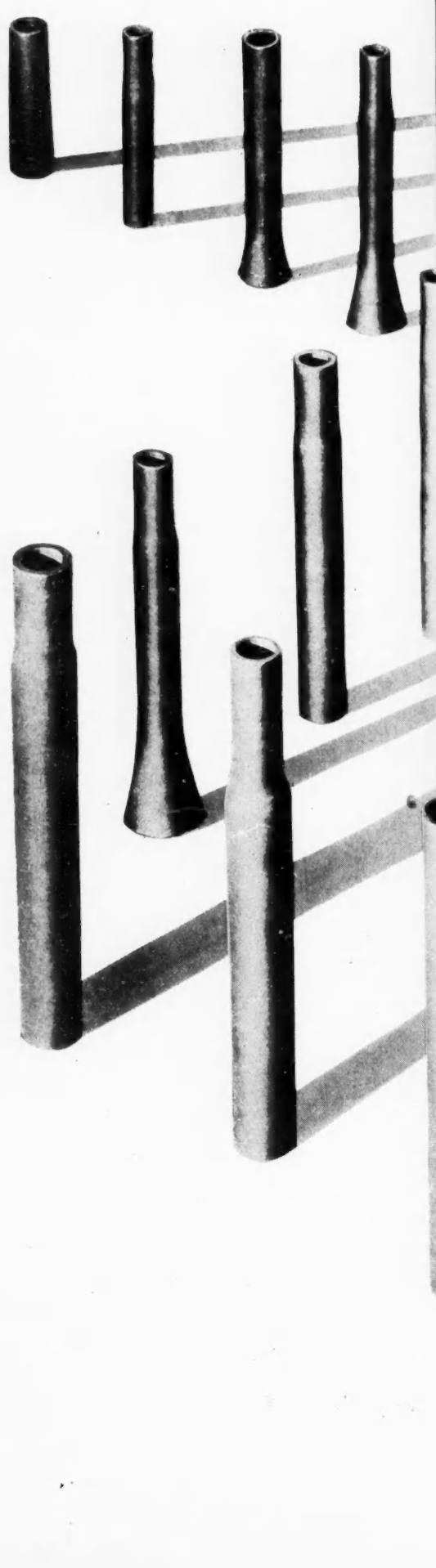
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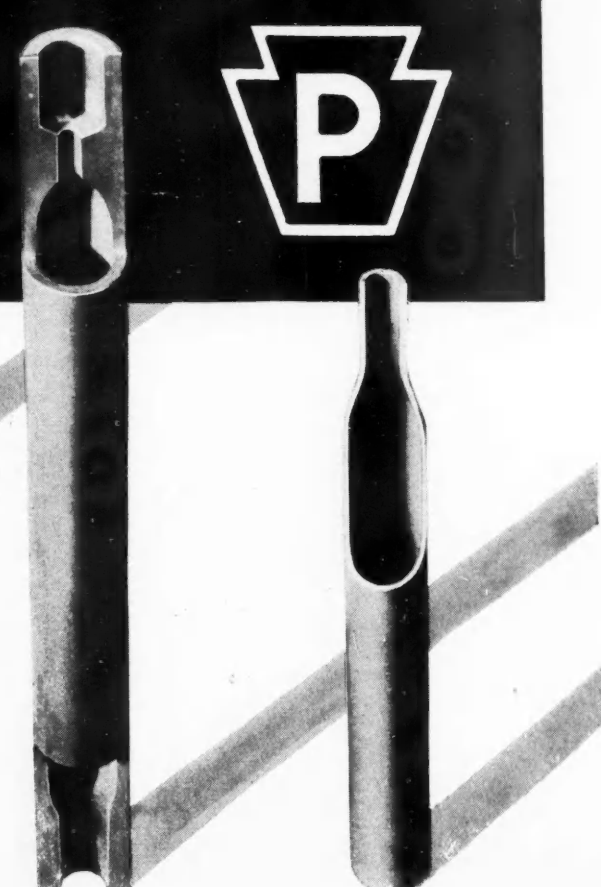
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AUTOMOTIVE INDUSTRIES

The **AUTOMOBILE**

Volume 68

Reg. U. S. Pat. Off.

Number 15

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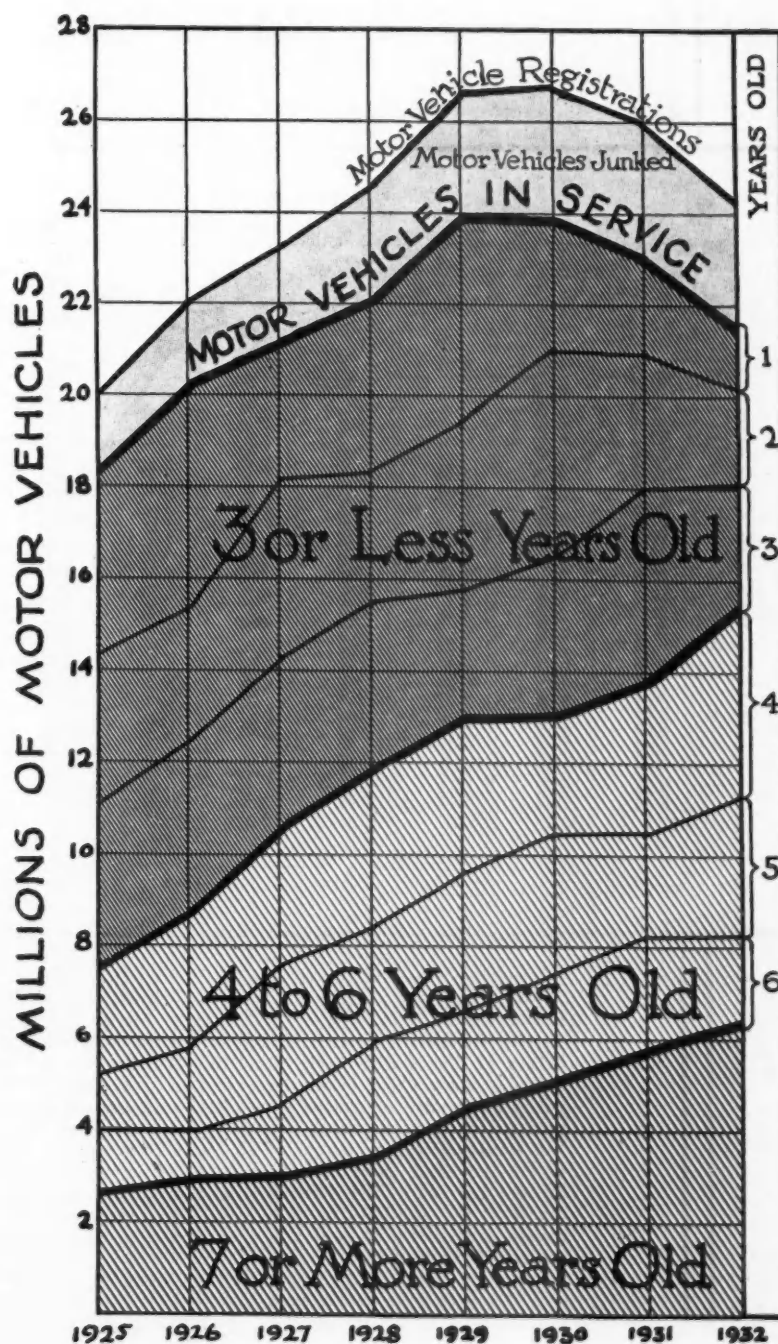
Automotive Industries

Old Cars Present Factories with New Service Problems

Forty-Four Per Cent Shrinkage in Car Dealers Primary Service Market Indicates Need for Broadening Appeal to Bring Older Cars Into His Service Station

by Don Blanchard
and M. A. Ainsworth

THREE years of sub-normal new car sales have reduced the class of owners from which car dealers ordinarily have gotten the bulk of their service business by 44 per cent—from nearly 11,000,000 to approximately 6,000,000. Only about a quarter of the cars on the road are less than three years old and it is on these newer cars that dealers have depended mostly for maintenance business. This proportion contrasts sharply with the situation at the end of 1929 when more than 45 per cent of the cars in service were three or less years old.



With service currently of such vital importance to the continued existence of dealers, such a fundamental change in their service market becomes an immediate concern of the car manufacturer. Moreover, the effects of such change on future sales of factory parts departments is also a matter of some moment. Consequently, the desirability, if not the necessity, of car makers giving serious consideration to how their dealers can broaden their service selling to get more business on cars three or more years old, is clearly indicated. The success with

which efforts in this direction meet may well be a factor of real importance not only in keeping dealers in business, but also in maintaining factory sales of service parts.

Generally speaking it is probably safe to say that car dealers have been getting the bulk of their service business from owners of cars less than three years old. Dealers with whom we have checked place the percentage at between 70 and 80.

There are a number of reasons for this condition. The sale of the new car having established the initial contact, it has been easier to retain the owner as a customer, particularly with the aid of free service during the warranty period. After the car has been traded for the first time, however, it has not been so easy to establish and maintain contact with its owner.

Perhaps in two cases out of three some other dealer makes the trade and resells the car. Unless he makes some special effort to hold the used car buyer's service business, which he commonly does not, the natural tendency is for the used car owner to patronize some convenient independent shop. The dealer, who sold the car new, tends to be equally lax in his follow-up so that it is probably true that a substantial percentage of used car buyers are not placed under any strong pressure to patronize dealer shops.

The natural result is that there is a strong tendency for dealer service to be sold to first owners. This tendency is stimulated by any difference in prices between dealer and independent shops as cost is a more important item to the used car buyer.

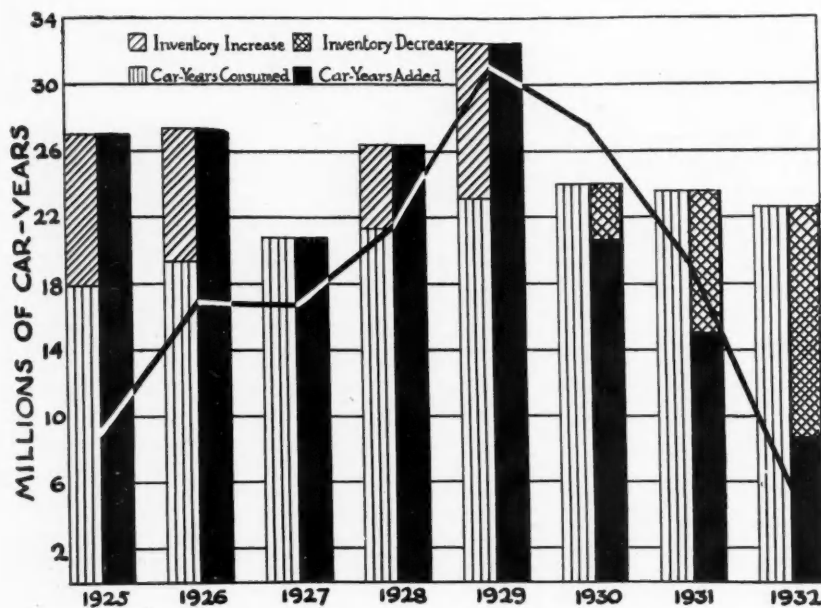
At the end of 1929 when there were approximately 11,000,000 cars on the road less than three years old, relatively the service business of owners of older cars was not so important to the car dealer and his factory. The owners of newer cars were numerous enough then to provide him with more service prospects than he was ever successful in selling. Three years of sub-normal sales have changed the situation tremendously.

Now there are only about 6,000,000 owners of cars less than three years old. Unless effective measures are taken to bring a larger share of the service on older cars into dealer service stations, the chances of his maintaining his service volume and of factory's maintaining their relative position in parts distribution, appear to be somewhat unfavorable.

The methods to be taken to get the older cars in include, of course, more intensive as well as more extensive follow-up, and very probably adjustments in prices and in the scope of service operations to make them attractive to the owners of older cars and at the same time profitable to the dealer. Possibly this will necessitate the elimination of some of the "extras" in standard service operations. Probably too, a sharp scaling down of costs will be necessary in many dealer shops.

Whatever the most effective remedies may be, it is obvious that broadening the dealer's service sales program so that he gets more business from owners of cars more than three years old has become a matter of more than passing importance to the car factory as well as its dealers.

Turning now to other effects of the depression on the public's automotive rolling stock, the end of the



There was less unused automotive transportation in the public's hands at the end of 1932 than at the end of 1925, despite the fact there were 17 per cent more motor vehicles in use at the end of last year. This is indicated by the irregular curve which shows the accumulated changes in the public's inventory of unused transportation measured in car-years—each new car being considered equal to 7 car-years. The blocks show the number of car-years consumed in each of the last eight years and the number of car-years added by new car sales. The differences also are shown and they represent the additions or deductions from the inventory of unused transportation, which are accumulated to form the curve first referred to.

Eight-Year Trends in Car Use, Junking, Average Age and Age Distribution

(End-of-Year Figures)

(Car as used here includes both cars and trucks)

	1925	1926	1927	1928	1929	1930	1931	1932
Motor vehicles in use...	18,310,000	20,330,000	21,160,000	22,120,000	23,980,000	23,950,000	23,080,000	21,500,000
Motor vehicles junked...	1,630,000	1,810,000	2,110,000	2,510,000	2,670,000	2,880,000	2,910,000	2,870,000
Motor vehicles registered	19,940,000	22,140,000	23,270,000	24,630,000	26,650,000	26,830,000	25,990,000	24,370,000
Average age, motor vehicles in use, years...	3.1	3.2	3.5	3.6	3.6	3.8	4.2	4.4
Average age, motor vehicles junked, years...	6.2	6.3	6.2	6.4	6.5	6.6	6.8	7.0
Car-years consumed*	17,910,000	19,370,000	20,750,000	21,300,000	23,100,000	24,000,000	23,560,000	22,560,000
Car-years added by new car sales	26,860,000	27,350,000	20,520,000	26,430,000	32,370,000	20,650,000	15,040,000	8,750,000
Difference — car-years. This difference represents the change in the public's inventory of unused automotive transportation	+8,950,000	+7,980,000	-230,000	+5,130,000	+9,270,000	-3,350,000	-8,520,000	-13,810,000
Motor vehicles in use:								
Number 3 or less years old	10,950,000	11,000,000	10,580,000	10,300,000	10,990,000	10,860,000	9,260,000	6,150,000
Number 3 to 6 years old, inclusive	4,750,000	6,350,000	7,610,000	8,420,000	8,510,000	8,060,000	8,100,000	9,000,000
Number 7 or more years old	2,610,000	2,980,000	2,970,000	3,400,000	4,480,000	5,030,000	5,720,000	6,350,000

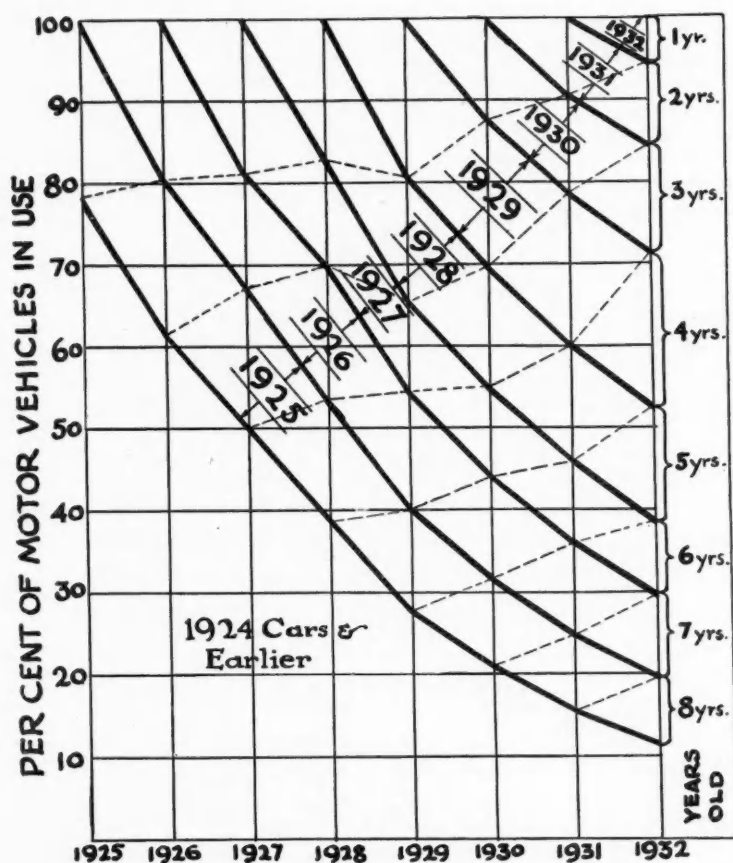
Motor Vehicles in Use at the End of Each Year by Year of Manufacture Percentages of Total in Use

1932	....	....	....	....	....	....	....	5.85
1931	....	....	....	....	....	....	9.21	9.85
*Assuming average 1930 car-life to be 7 years, a new car is considered to be equal to 7 car-years of transportation.	....	....	....	....	....	12.15	12.38	12.91
1929	....	....	....	....	19.12	18.66	18.50	18.80
1928	....	....	....	17.08	15.30	14.52	14.05	13.77
1927	....	....	14.16	12.96	11.34	10.50	9.79	9.22
1926	....	19.67	18.44	16.50	14.01	12.53	11.23	....
1925	21.62	18.91	17.32	15.01	12.37	10.62	....	....
1924	18.23	15.60	13.87	11.63	9.18	....	....	....
1923	20.01	16.60	14.27	11.51	....	....	....	....
1922	11.80	9.45	7.81	....	....	....	....	....
1921	6.80	5.25	....	....	....	....	....	....
1920	7.39	....	....	....	....	....	....	....
More than 6 years old...	14.15	14.52	14.13	15.31	18.68	21.02	24.84	29.60
Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

last decade found owners with a well-stocked inventory of unused motor transportation. This inventory has been undergoing steady and rapid depletion. In fact, the bottom of the bin is not much further away.

Since 1929, owners have consumed 70,120,000 car-years of automotive transportation. During this

three-year period sales of new cars and trucks totaled 6,348,000, and, figuring their average life at seven years, these sales represent 44,440,000 car-years added to the public's inventory. The difference between the latter figure and consumption is 25,680,000 car-years, the equivalent of 3,670,000 new cars. It would take sales of that many new ve-



The heavy curves show the changes in the percentages of cars in use of each year's manufacture—for example, at the end of 1926, 20 per cent of the cars in use were made in 1926 while at the end of 1932 only about 10 per cent were 1926 cars. The dotted lines show the year-to-year changes in the percentages of 1, 2, 3, etc., year old cars.

hicles to restore the public's inventory of *unused* transportation to its 1929 level.

The public therefore has consumed during the three depression years 58 per cent more automotive transportation than it has purchased. The excess of consumption figured at the 1932 average of \$730 per vehicle, is the equivalent of \$2,679,000,000 in retail sales. Viewed from another angle, the number of cars retired from service in the last three years has exceeded sales by 2,312,000.

As a consequence of these changes, the average age of cars on the road has increased from 3.60 at

the end of 1929 to 4.44 years at the end of last year. At the end of 1933, the average age will be 5 years—only two years from the junk-pile.

Under the pressure of rapidly shrinking purchasing power, analysis indicates owners are driving their cars further before junking them. This is indicated by the changes in the calculated ages of cars junked. In 1929, the average age of cars junked was 6.53; in 1930 it was 6.65; in 1931, 6.83, and in 1932, 6.97. This year an average age for junkers of 7.36 years is indicated. On the basis of these admittedly rough estimates, the average car lives about 10 months longer than in 1929 before the wrecker serves the death warrant.

If we have confidence that our

standard of living is not going to be permanently impaired, and most of us have, these various measures of the rate at which the public has been using up its automotive rolling stock are an assurance of future markets. When these markets will become effective depends, of course, on the rapidity with which public purchasing power is restored. Despite this uncertainty, the tenacity with which the public has clung to its automobiles in the face of hard times, encourages the belief that these facts about the fast-growing potential replacement market, foreshadow big years ahead.

Editor's Note—For the statistically minded, perhaps an explanation of the source of the figures used in the foregoing and in the accompanying charts and tables is in order. The basic data are registration and production figures. Junkers were calculated by the method developed by O. P. Pearson of the National Automobile Chamber of Commerce, with the 1932 figure partially estimated. "Cars in Use" figures represent simply the difference between registrations during a year and the number of cars junked in that year.

In calculating age distribution, use was made of Prof. Griffin's mortality figures. The Griffin figures were developed seven or eight years ago and perhaps do not apply with their former accuracy due to changed economic conditions and improvements in automobile design. They do appear to be sufficiently accurate, however, to justify their use in the manner they have been employed here.

Estimates of cars junked based on the Griffin figures show the following percentage variations from the results obtained by the probably more accurate Pearson method which employs registration and sales data: 1924, —2.8 per cent; 1926, +0.5 per cent; 1927, —6.1 per cent; 1928, —6.7 per cent; 1929, —7 per cent; 1930, —0.6 per cent; 1931, +5.2 per cent. Computed cars in use by the Griffin method show the following percentage variations from the estimates obtained by subtracting junkers as calculated by the Pearson method from registration: 1925, —3.2 per cent; 1926, —2.5 per cent; 1927, —2.3 per cent; 1928, —0.1 per cent; 1929, +0.7 per cent; 1930, +1.3 per cent; 1931, +1 per cent. Obviously these errors are not large enough to affect materially the value of the Griffin figures as used herein.

JUST AMONG OURSELVES

A New Bait

THERE has long been a group of voluntary advisors hovering about the automotive industry voicing numerous reasons to support the idea that there is a good market in America for an automobile whose primary appeal is that of economy, whose size is small, but not diminutive and from which everything possible in the way of "gadgets" has been eliminated.

No car meeting all these requirements as properly defined, the group claims, has yet been built in America; and we agree with its members in that respect. Consequently, no one can yet prove by experience that they are wrong. Possibly they are right, at that, if we add the condition that the car must be in the very lowest price class on the market.

Still, every partial yet definite move in that direction ever made by any important manufacturer has rather quickly resulted in a back-track to larger size, slightly less economy, slightly increased luxury, etc. Any reader of these pages can name a number of individual instances in past and present model developments where a manufacturer has started off with a smaller size, economy-appeal car and then gradually worked back to larger size, more luxury and less economy.

But No Anglers

POSSIBLY, it seems to us, this is due to the fact that no manufacturer yet has been 100 per cent sold on the power of the

purely economy appeal to begin with; no one has yet been willing to stake his whole merchandising, advertising and design program on that one element.

While plumping one foot boldly in the lake of economy appeal, no manufacturer yet has been willing to remove his other foot from the dry land of competitive luxury - speed - power salesmanship.

Manufacturers have always felt it necessary, in other words, to claim everything any competitor might have *in addition to a basic economy appeal*. So far, no maker has been willing to say of his car:

"We give you economy primarily. With it we give you less top speed than some competitors, less acceleration, less riding comfort under some conditions and less of several other things. If you want those things, go and pay for them. We give you economy of first cost and, what is more important, permanent economy of operating cost. That's our point of definite superiority and we'll stake our all on it, because with it we do give you sufficient speed for any ordinary conditions, sufficient power for any ordinary conditions and a darned good ride for the price."

And because no manufacturer has seen a chance for profit in any such program, competitive claims have always driven him back to more or less competitive specifications.

All of which is meant to be in the nature of an interpretation of what has happened a number of times in the last 15 years, and not in any sense a criticism of it.

We are not personally convinced of the profit possibilities in the economy-car idea, although the depression has made us more sympathetic to the conception than once we were.

Plane Talk

NOVEL use of military aircraft is recorded by Sir Philip Sassoon, M.P., Under Secretary of State for Air, in a recent speech to the British Parliament. While airplanes were used extensively during the World War to fly over enemy territory and drop pamphlets of propaganda, we hadn't heard before of their being employed for broadcasting peace terms direct.

Suppression of a turbulent tribal chief in Iraq, it seems, presented a difficult problem recently because he was secure in a "savage wilderness of a district where the mountains rise to a height of 10,000 ft. and road communications are almost non-existent."

Ground forces of soldiery failed to dislodge this chief. Aircraft were then dispatched to the area, first to bring supplies to the attacking ground forces. Then, says Sir Philip:

"Proclamations calling upon the tribesmen to surrender and giving them notice that air action would otherwise be taken against them were then broadcast in the vernacular from a troop-carrying aircraft which had been fitted with a high-powered loud speaker."

Complete success, it appears, was ultimately achieved, but not entirely through loud speakers, one would guess, since "active operations from the air had to be undertaken against certain recalcitrant sections."—N. G. S.

Bendix-Westinghouse

Introduces—

Air Steering Control

Positive, sensitive control and compensation for shimmy among features of new equipment developed to reduce effort required to guide vehicles

by S. Johnson, Jr.

Chief Engineer of the Bendix-Westinghouse Automotive Air Brake Co.



Officials of the Bendix-Westinghouse Co. inspect the air steering unit on the company's experimental truck. Left to right they are: R. M. Heinrichs, S. Johnson, Jr., D. H. Robinson, C. A. Ohl

BECAUSE of a tendency to place greater loads on the front wheels of modern motor transport vehicles, proper steering control has become a problem of growing acuteness. True, ratios have been increased in an effort to correct existing conditions, but this adjustment falls short of producing the desired results. Obviously enough, the problem lends itself readily to power control. Viewing the situation from this angle and realizing fully the inherent flexibility of air as a power medium, Bendix-Westinghouse research engineers, several years ago, set about the task of producing a dependable air steering control. After a systematic elimination of various methods and combinations, a double-acting cylinder, controlled by a double-valve arrangement, seemed to be the solution to the problem.

Two years of development followed and culminated in the installation, last June, of the first air steering unit on the Bendix-Westinghouse experimental truck in the Pittsburgh laboratories. Preliminary tests proved so successful that the truck was sent on a nation-wide tour in which 30,000 miles were covered in nine months. At the

conclusion of this test the unit was approved by the company and made available for immediate installation.

Bendix-Westinghouse air-steering control consists primarily of three major parts, namely, the combination of levers A mounted directly on steering shaft 2, control valves B and the double-acting cylinder C. The control valves are of the self-lapping type and mount for convenience directly on the double-acting air cylinder, each valve controlling one side of the cylinder. The air pressure delivered to the cylinder is proportional to the force delivered on top of the valve piston plunger. The valves are actuated by rocker arm 3, which insures that air is delivered to one side of the cylinder at a time. These valves are so adjusted that the air can be exhausted from both sides of the double-acting piston simultaneously, but air pressure can be

delivered to only one side at a time.

The present pitman arm A of the steering gear is made up for control purposes of three distinct levers; the control lever 4, the intermediate lever 5, and the pitman arm 6. The control lever 4 is fixed directly to the steering shaft. The intermediate lever 5 is fulcrumed at the pitman arm through pin 7. The lower end is connected to the control lever through pin 8. The upper end of the lever 5 is bored slightly larger than the steering shaft, so that a free motion is obtained for the operation of the control valves 9 and 10. The drag rod 11 is connected at the extreme end of the pitman arm, and brake cylinder C is connected between the drag rod 11 and pivot point 7 of the intermediate lever 5. Yoke 12 is mounted on the upper end of intermediate lever 5, so that the control rod 13 will be kept in a

straight line with the steering gear camshaft.

The operation of air steering control is as follows:

Manipulation of the steering wheel will turn the control lever 4 in one direction or the other. If the steering wheel is manipulated for a right-hand turn, the control lever 4 will move to the right. As there is always present a resistance to turning of the wheels, the control lever 4 will move the upper end of the intermediate lever 5 to the left, due to the fact that the intermediate lever is hinged on the pitman arm at 7. The movement of the upper part of the intermediate lever 5 will cause a movement of the valve rod and through the rocker arm 3 exerts pressure on the plunger of control valve 9, which is connected to the left side of the double-acting piston 14. Thus air under pressure will be admitted to the cylinder until the cylinder force is equivalent to the resistance of the wheels to turn and move the pitman arm 6 to the right. As long as the steering wheel is turned the valve will remain open. When the movement of the steering wheel is stopped the movement of the piston 14 will continue until it moves the upper end of the intermediate lever 5 to a

position that will allow the intake valve 15 to close and cut off additional flow of air. To maintain a certain air pressure in the air cylinder it is necessary to maintain a certain force on the plunger of the control valve piston. For the left-hand turn the right-hand control valve 10 will be actuated, and air will be admitted to the right-hand side of piston 14, thereby moving the pitman arm to the left.

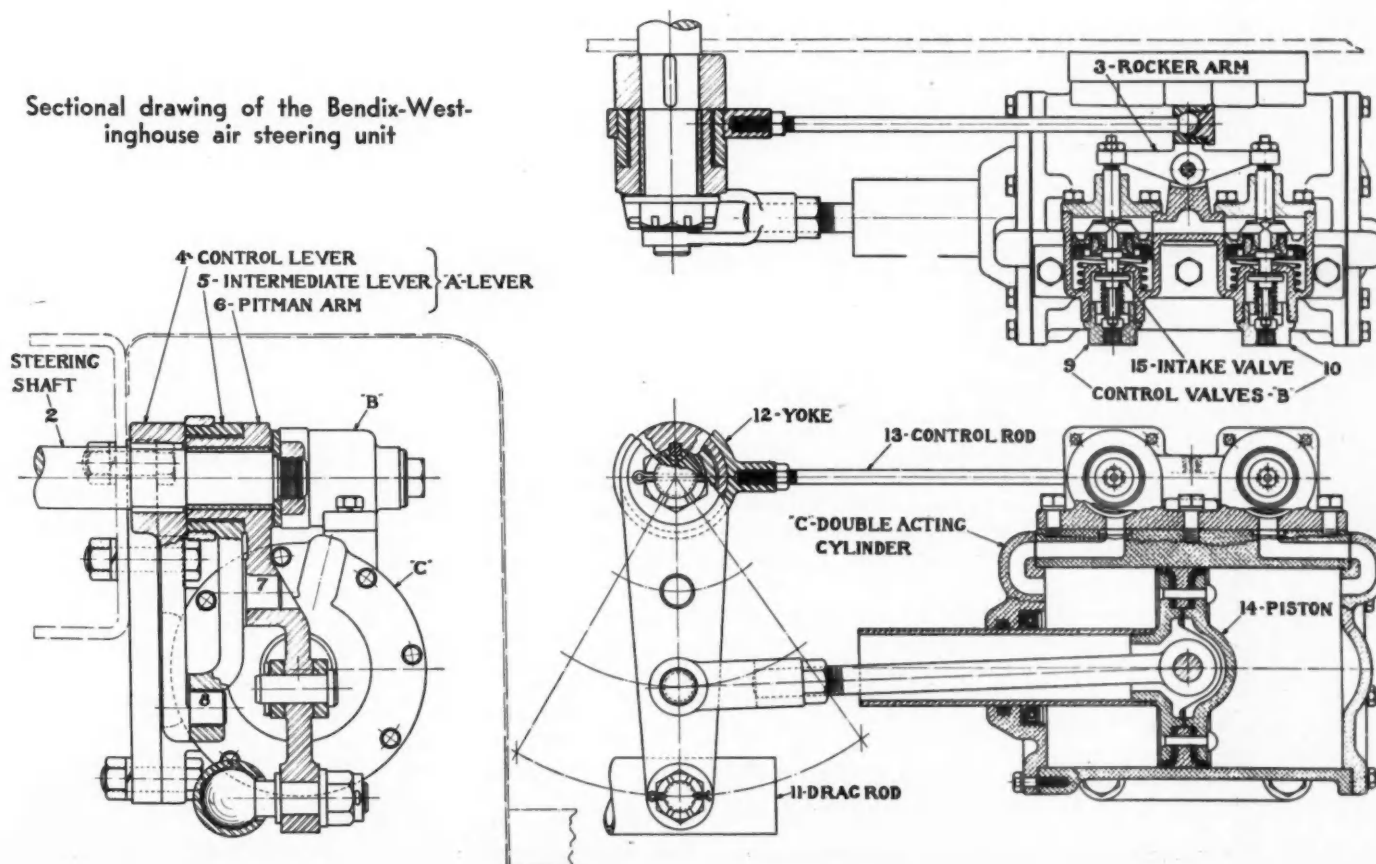
Air steering control reduces road shock considerably and minimizes a shimmy condition. This is due to the fact that the control valve is reversed through a very slight movement of the drag link. If the movement of the wheel, due to shimmy, is in the direction in which the wheel is turned, the air in the double-acting cylinder will be exhausted, and pressure admitted to the opposite side of the double-acting cylinder C, thereby obstructing further movement of the wheel. If the shimmy movement of the wheel is against the turn of the wheel it will produce additional force on the pitman arm, which will cause a slight kick-back on the control arm and increase the pressure in the control valve, which will naturally add resistance against the force of the wheel. For this reason it is practically im-

possible to build up a shimmy to an extent that would be noticeable by the driver.

Among the advantages offered by this air-steering device is its ability to reduce greatly the effort required on the part of the operator. Owing to its great power, its use will permit a substantial reduction of gear ratios. Further, steering is accomplished by a combination of manual effort and power, and the driver, in steering, must overcome a certain predetermined resistance exactly proportional to the angle of turn. This feature ensures positive control at all times, even in the remote event of power failure. The normal air consumption of the system constitutes an almost negligible drain on the vehicle's existing pneumatic system.

Beyond its obvious features, air steering automatically compensates for a possible shimmying of the wheels and very substantially reduces the load on the steering-gear worm. Its simplicity of design, ready adaptability to neat, compact installation in conjunction with existing types of conventional steering gears, and its reliability of operation will permit its general use and pave the way for future necessary changes in the design of trucks and buses.

Sectional drawing of the Bendix-Westinghouse air steering unit



Ask Us About
the **NEW Sennett**
ECONOMY
Special

**12 to 44% More Miles
per Gallon of Gasoline
and Oil**

**LOWER
Maintenance
COSTS**

Would Economy

Would this sign on a dealer's
window bring prospects into
his salesroom?

Admittedly the American people have always demanded performance even if it meant buying more gasoline. Probably most of them still prefer activity even at a sacrifice of economy.

But in these days when a nickel looks bigger than a quarter did in 1929, perhaps there now are enough owners interested in fuel economy to make it profitable for factories to give the subject some special attention. That decreasing the rear axle ratio increases fuel and oil economy, and reduces wear and tear on the engine and other parts, has been known probably as long as there have been automobiles. These reductions in cost are, of course, at the expense of performance. But perhaps there are some prospects who would be willing to shift gears oftener to save on operating costs. With today's easy-shift transmissions, quiet second speeds, free-wheeling and automatic clutches, changing speeds isn't nearly so objectionable as it once was.

In the accompanying article, Mr. Heldt analyzes the gains and losses resulting from a 20 per cent reduction in the rear axle ratio of a 3000 lb. car of typical design. For the non-technical reader here briefly is what he found:

1. Miles per gallon of gasoline would be increased by about 12 per cent at 25 m.p.h.; by 16 per cent at 45; by 30 per cent at 60 and by 44 per cent at 65 m.p.h.
2. At least as large savings in oil con-

sumption particularly at high speeds, would be realized.

3. A reduction in maintenance expense due to the 20 per cent decrease in engine revolutions per mile, offset to some extent by the increased amount of second-speed operation.
4. A 29 per cent reduction in high-gear acceleration at 25 m.p.h.; a 25 per cent reduction at 45 m.p.h., and smaller percentage losses in performance at higher car speeds. This, of course, would make more frequent resort to second speed necessary in traffic and hilly country. On the other hand the reduction in engine revolutions would make high-speed, cross country operation quieter and smoother.

Will enough people think the economies worth the losses in performance to make the offering of special gear ratios profitable? Obviously this question can't be answered on theoretical grounds. A real test of public reaction is required.

It wouldn't cost much to find out what the public reaction would be. Production of a few sample cars with low gear ratios and their exploitation as "economy specials" through a few dealers, wouldn't involve any considerable expense.

Moreover, if any buyer of an "economy special" felt subsequently that normal performance was worth more to him than "abnormal" economy, the cost of changing his car over to standard specifications would involve only the substitution of a ring and pinion gears.—D. B.

Sell Lower-Geared Cars?

Perhaps Enough Owners NOW Are Ready to Sacrifice Performance for Better Economy to Make Supplying SPECIAL Low-Geared Models Profitable to Industry

by P. M. Heldt,

Engineering Editor,
Automotive Industries

MANY motorists, no doubt, at one time or another have felt that their cars were geared entirely too low for best fuel economy and least wear and tear on the engine. The low gears (or high rear-axle ratios) generally used on our cars are the result of the American driver's aversion to gear shifting. He wants to be able to take everything in high and use the shift lever as little as possible. It is not unlikely, however, that now that gear shifting has been made so easy by free-wheeling units, synchronizing devices and automatic clutches, drivers will be more willing to shift gear somewhat more frequently if they can be made to see the incidental advantages of a design of car requiring more frequent shifts. It will be shown in the course of this article that the ability to do everything in high is obtained at considerable expense by way of additional fuel and oil consumption and additional wear and tear on the engine, and it is not at all unlikely, therefore, that the new economic conditions also will have the effect of causing motorists to yield somewhat in their demands for "performance" or "snap."

Let us take a representative car of the small, popular-priced type, with an engine developing between 60 and 70 hp. maximum. Such a car normally has a rear axle ratio of about 4.4. So far as handling the car under normal conditions is concerned, a much smaller rear-axle ratio would do, but, of course, the acceleration in high gear would

then be reduced. On the other hand, the maximum speed would not necessarily be reduced and even may be increased; the fuel economy will be very materially increased, especially at the higher

speeds, and the wear and tear on the engine will be greatly lessened, especially if the driver is in the habit of driving "all out" most of the time.

We will assume that the ratio is made about 20 per cent smaller than usual, or 3.5, and the question then is, What will be the effect on the maximum speed, the acceleration, and the specific fuel consumption, or, inversely, the gasoline mileage?

The car considered is one which, with two passengers up, weighs about 3000 lb. and may be considered to have a total frontal area of 25 sq. ft. Then, figuring with a rolling resistance of 18 lb. per 1000

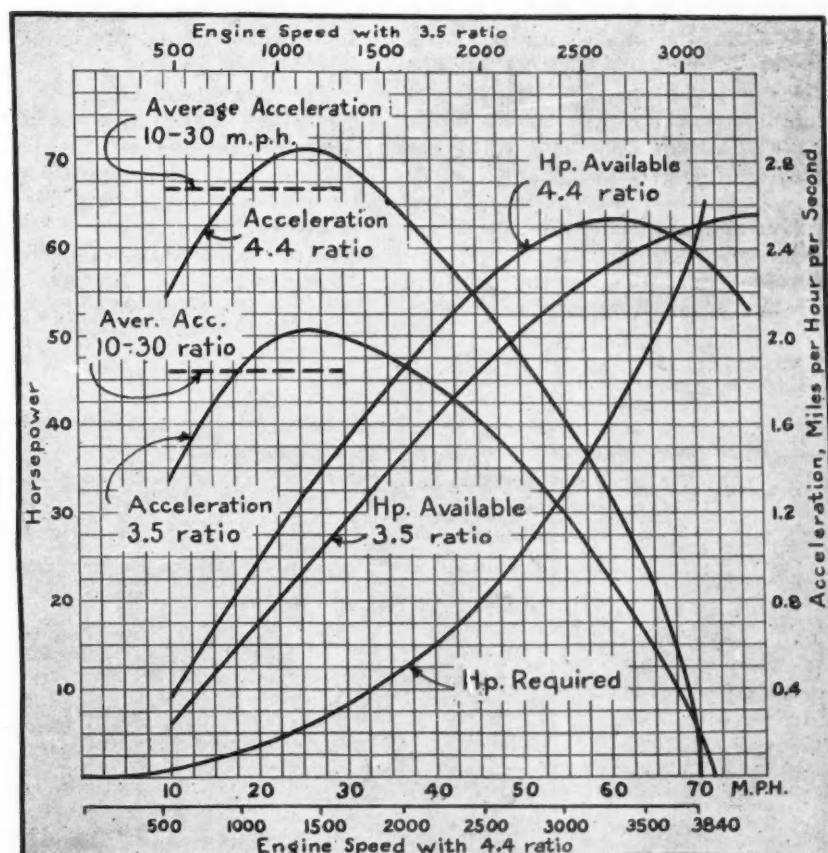


Fig. 1—Curves of horsepower required and horsepower available and maximum acceleration for a 3000-lb. car with rear axle ratios of 4.4 and 3.5 respectively

and an air-resistance coefficient of 0.0022, the relation between the speed of the vehicle and the horse power required for its propulsion will be as shown in Fig. 1. By now assuming that the car is equipped with wheels having an effective diameter of 27 in., we can superimpose horse power-available curves on the horse power-required curve for both rear axle ratios, viz., 4.4 and 3.5. The engine, by the way, develops 63.5 hp. at 3400 r.p.m. and at other speeds the output varies in accordance with average proportional horse power curves.

The engine speeds, corresponding to 60 m.p.h. with the two rear-axle ratios, respectively, are as follows:

$$\frac{336 \times 60 \times 4.4}{27} = 3290 \text{ r.p.m.}$$

and

$$\frac{336 \times 60 \times 3.5}{27} = 2620 \text{ r.p.m.}$$

Engine speeds at other car speeds are in direct proportion to the latter, as long as the rear-axle reduction ratio remains the same.

It will be seen from Fig. 1 that with the 4.4 rear-axle ratio, the car has a maximum speed a trifle less than 70 m.p.h., while with the 3.5 ratio the maximum speed is about 71 m.p.h. Whether or not the maximum speed of the car will be increased or decreased by a change in the rear-axle ratio depends, of course, very much upon the particular part of the horse power-available curve where it is intersected by the horse power-required curve. If in the original car the intersection occurred at the

peak of the horse power-available curve, then evidently a decrease in the rear-axle ratio would result in a decrease in the maximum speed, for with the same car the speed goes up and down with the horse power expended in its propulsion, and if the horse power-required curve in the first place intersected the horse power-available curve at the peak of the latter, with the changed rear-axle ratio, it would intersect the horse power-available curve at a point corresponding to less than peak horse power, hence the speed would be reduced.

Usually in modern cars the horse-power-required curve intersects the horsepower-available curve at a point corresponding to a speed about 15 per cent higher than the peaking speed. With the rear-axle ratio so chosen as to make the engine speed at maximum car speed about 15 per cent greater than the engine peaking speed, plenty of power is available for acceleration over practically the whole speed range. It is only within the last few miles of the speed range that the horsepower required is nearly equal to the horsepower available. The two curves then approach each other rapidly, the former decreasing and the latter increasing strongly. Thus, rapid acceleration is possible almost throughout the whole speed range.

The power available for car acceleration at any car speed is measured by the height of the vertical ordinate for that car speed between the power-available curve and the power-required curve. It will be seen at once that considerably more power is available for acceleration with the 4.4 than with the 3.5 axle

ratio throughout the speed range. To get an idea of the accelerations possible with the two ratios, we have to figure them out for each ratio and plot the results. From the horsepower available for acceleration at any speed, and the speed, we first calculate the force available for acceleration from the equation

$$F = 375 \frac{\text{hp.}}{V} \text{ lb.,}$$

where hp. is the horsepower available and V the speed in miles per hour. Next we determine the acceleration which this force gives to the car and load. This we can do by means of the equation

$$a = \frac{Fg}{W} \text{ feet per second per second}$$

$$\text{or } \frac{Fg}{1.467 W} \text{ miles per hour per sec-}$$

ond where g is the acceleration of gravity (32.16) and W the weight accelerated. Let us take, for instance, the car with the 4.4 ratio at 30 m.p.h. From the curves it will be seen that at this speed there is a total of 30 hp. available for acceleration. This gives an accelerating force of

$$375 \frac{30}{30} = 375 \text{ lb.}$$

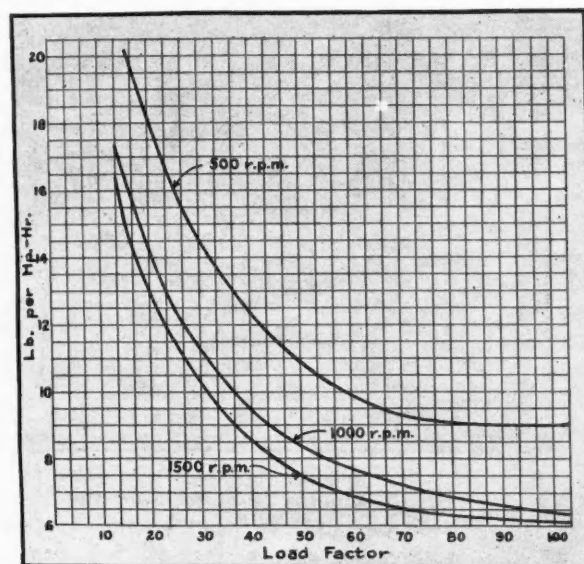
and the acceleration produced will be

$$\frac{375 \times 32.16}{1.467 \times 3000} = 2.74 \text{ m.p.h. p. sec.}$$

Accelerations for all other points of the speed range were calculated for both the 4.4 and the 3.5 axles, and the results are plotted in Fig. 1. In both cases, the car accelerates the most rapidly at about 25 m.p.h. The maximum acceleration for the car with the 4.4 ratio is 2.84 m.p.h. p. sec. and that for the car with the 3.5 ratio, 2.02.

The accelerating abilities of the two cars probably can be better visualized if expressed in times required to accelerate through a certain speed range, as from 10 to 30 m.p.h. or 10 to 40 m.p.h. These times can easily be found by averaging the accelerations over these ranges and then dividing the speed difference by the average acceleration. For instance, the average acceleration of the car with the 3.5 rear axle between 10 and 30 m.p.h. is 1.835 m.p.h. p. sec., and the time required for its acceleration from 10 to 30 m.p.h. is therefore

Fig. 2—Variation of specific fuel consumption of engine with load factor at 500, 1000 and 1500 r.p.m.



$$20 / 1.835 = 10.9 \text{ seconds}$$

while over the speed range 10-40 m.p.h. the average acceleration with this ratio is 1.85 m.p.h. p. sec., and the time required to accelerate through this range, therefore, is

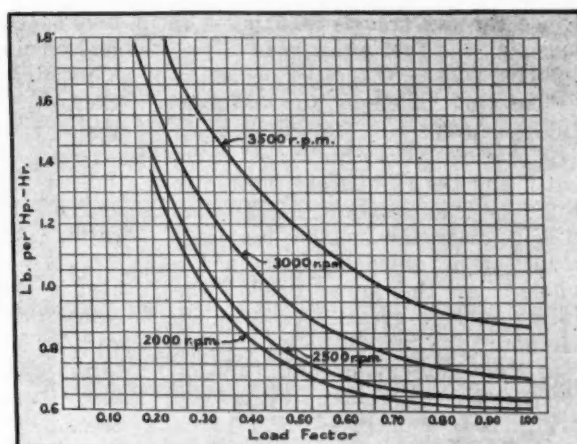
$$30 / 1.85 = 16.2 \text{ seconds.}$$

With the 4.4 rear axle ratio, the average acceleration between 10 and 30 m.p.h. is 2.66 m.p.h. p. sec., and the time required for the acceleration is

$$20 / 2.66 = 7.5 \text{ sec.}$$

The average acceleration between

Fig. 3—Variation of specific fuel consumption of engine with load factor at 2000, 2500, 3000 and 3500 r.p.m.



sumption decreases continuously as the load factor is increased. The fuel consumption is lowest at intermediate speeds, 1500-2000 r.p.m., and increases toward both ends of the speed range.

Fuel economy at any speed is best expressed by the fuel mileage at that speed. In determining this from the data already given, we proceed as follows:

Take, for instance, the car with 4.4 reduction ratio, at the speed at which its engine turns over at 2000 r.p.m., viz., 36.4 m.p.h. By measurement on Fig. 1, we find that the actual load on the engine at this car speed is 12.5 hp. and the available power, 46.3, hence the load factor is $12.5/36.4 = 0.27$. Now, from Fig. 3 we see that the specific fuel consumption of the engine at 2000 r.p.m. and 0.27 load factor is 1.08 lb. per hp.-hr. The power actually delivered being 12.5 hp., and the specific consumption 1.08 lb. per hp.-hr., figuring one gallon of gasoline as equal to 6 lb., the hourly consumption is

$$\frac{12.5 \times 1.08}{6} = 2.25 \text{ gal.}$$

10 and 40 m.p.h. in this case is 2.64 m.p.h. p. sec., and the time required for the acceleration,

$$30 / 2.64 = 11.35 \text{ sec.}$$

The chief object of the lower rear-axle ratio is, of course, increased fuel mileage. When a lower rear-axle ratio is used at any particular car speed, the engine carries a greater percentage of its maximum load, and the brake thermal efficiency increases with the "load factor." The efficiency of the engine also varies with the speed, and specific fuel consumptions for an engine of the type and size here considered are shown in Figs. 2 and 3. At any given engine speed, the specific fuel con-

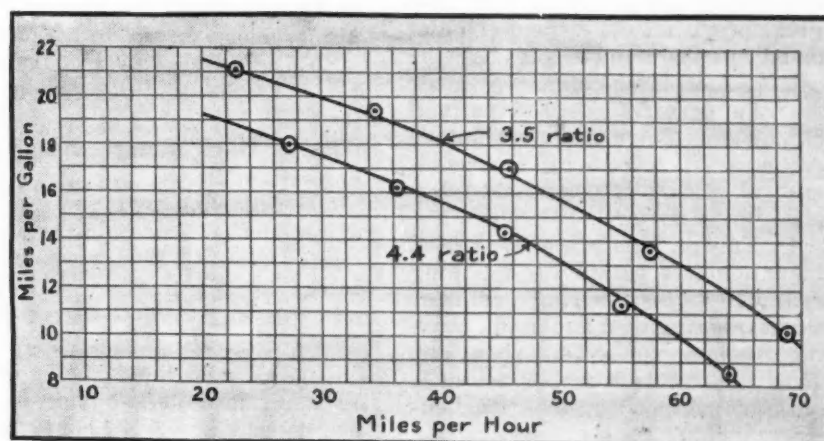


Fig. 4—Variation of fuel mileage with speed for the two-gear ratios

Since the car travels 36.5 miles in an hour, the fuel mileage is

$$36.5 / 2.25 = 16.2 \text{ miles per gal.}$$

The fuel mileages for different engine speeds and for both rear-axle ratios were similarly calculated, and the results are plotted in Fig. 4. The increase in the fuel mileage with the smaller rear-axle reduction is quite marked on the whole. At the lower speeds the gain is not so great. At 30 miles per hour, for instance, the smaller gear reduction gives a mileage of about 20 per gallon, while the larger reduction gives 17.6 miles per gallon, which represents an advantage of 13.5 per cent for the former. But near the upper end of the speed range the difference is very marked. At 65 m.p.h., for instance, the car with the low rear-axle ratio has a fuel mileage of about 11.9 per gallon, while that of the car with the high gear ratio is only about 8.3. Hence at this speed the gain in mileage, due to the lower gear reduction, is about 43 per cent. The principal reason for this large gain at high speeds is that the engine of the car with the high gear ratio is running at exces-

sive speed, at which its brake thermal efficiency is comparatively low. This high speed also is injurious to the working parts of the engine, which are much more highly stressed than at lower speeds.

The high engine speeds associated with high rear-axle reduction ratios not only increase the specific fuel consumption, but have an even more potent effect on oil consumption. In a paper on Pistons and Oil-Trapping Rings for Maintaining an Oil Seal, presented before the Indiana Section of the S.A.E. by Harry M. Bramberry of the Perfect Circle Company in 1928, oil mileage-car speed curves are given, which show that with one type of piston rings the oil mileage is 7.5 times as great at 70 as at 20 m.p.h., and with another type, 12 times as great. Of course, great efforts have been made by engine designers in recent years to overcome the defect of excessive oil consumption at high speeds, but the underlying causes tending to increase the specific consumption with increase in speed will always remain.

That a reduction in the rear-axle

ratio will reduce the fuel consumption per mile and have other favorable effects is no new discovery but has been known to engineers for a long time. Repeated attempts to make these advantages available to the motoring public have been made, such as the Graham car with low-reduction rear axle and four-speed gear of 1928; the Auburn, with two-speed rear axle, and various European cars with over-speed gears incorporated in the propeller-shaft assembly. The object of the present article is merely to give some concrete figures on the magnitude of the possible savings on fuel alone.

\$100,000 for Cars!

THE Egyptian Ministry of Communications during the fiscal year beginning May 1 next will expend about \$100,000 for the purchase of motor vehicles of different types. It is expected to purchase from 105 to 125 vehicles, hence the average price it is expected to pay is something less than \$1,000.

Krause Cemented-Carbide Boring Machine

SOME time ago we mentioned briefly a "fine boring" machine of great versatility, built by Ernst Krause & Co., A. G., Vienna. In view of the interest shown in this machine, further details are given below from information submitted by the manufacturers.

This machine, as illustrated, is a rugged, single-spindle unit designed specifically for high speeds and great precision. It utilizes the diamond or cemented-carbides for the cutting tool. Two claims are made for the performance of the machine: fine finish and guaranteed accuracy of 0.0004 in. in roundness, alignment of bores, and tolerances on diameter.

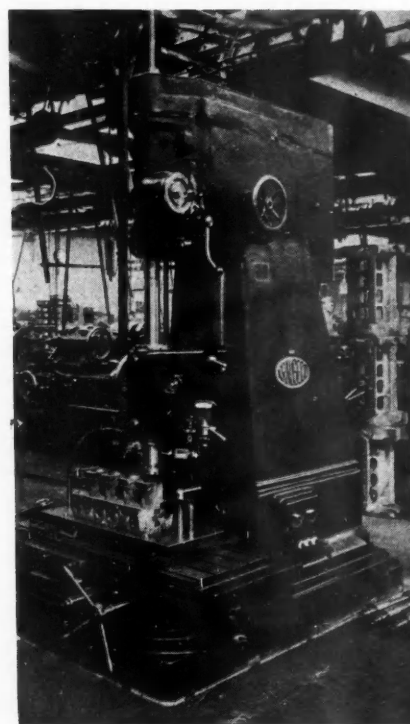
In Europe, this machine is used in automotive plants for finishing cylinder bores, boring cylinder sleeves, boring cam and crank bearings, boring connecting rods, etc. Thus it becomes a rather versatile piece of equipment and of particular value in a moderate production program.

The machine has a working range of $\frac{5}{8}$ to $6\frac{1}{4}$ in. diameter. It

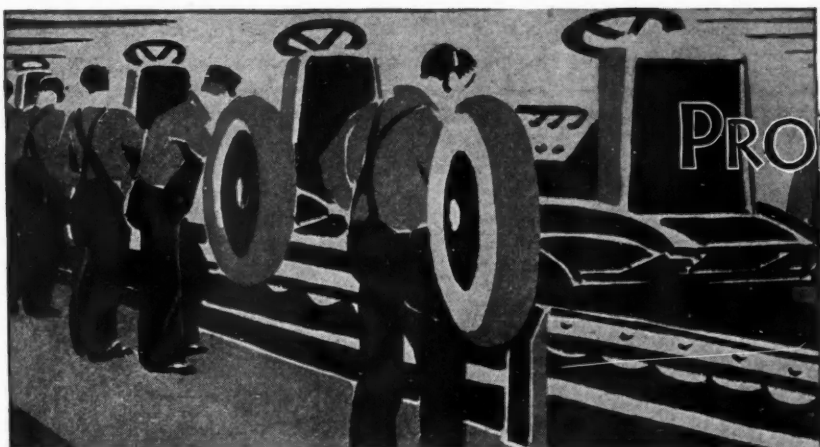
makes available 16 speeds and 16 feeds, the maximum speed range being 220 or 2940 r.p.m. Drive is from a 4 hp. motor. The machine weighs about 8000 lb. gross, and provides a working surface of 67 x 40 in.

The precision gaging device permanently attached at the side serves for the accurate adjustment of the boring tool. It consists of a micrometer screw in conjunction with a gage, reading to 0.00008 in. In production, the tool rather than the work is checked at frequent intervals, thus saving considerable inspection time.

The following are a few examples of production time on certain automotive jobs: Boring 4-cylinder blocks of $3\frac{3}{8}$ in. bore, approx. 4 min.; boring both ends of large Diesel connecting rods, $3\frac{1}{2}$ min.; boring cylinder liners, $4\frac{3}{4}$ x 13 in., 10 min.; floor-to-floor time boring in one setting, 7 camshaft and 5 crankshaft bearings with the aid of a special jig and multiple tool boring bars, $4\frac{1}{2}$ min.



Krause Cemented-Carbide Boring Machine



PRODUCTION LINES

Measures Humidity

Understand that the Bureau of Standards has worked out a method of improving the accuracy of the psychrometer under extreme atmospheric conditions. By slightly modifying the ordinary ventilated psychrometer, the Bureau has found it possible to correct the usual errors. The modified instrument is quite accurate up to 90 per cent humidity and at least up to 150 deg. F. Another report of great value is that a new chart has been developed for obtaining either relative or absolute humidity from psychrometer readings. It is said to be simpler and more accurate than those previously available.

How It's Done

Sixty company manuals were analyzed recently to see how various organizations are handling personnel problems. The digest of this material throws an interesting light upon the methods employed to acquaint employees with the policies of the company. This report should be a valuable tool to anyone concerned with personnel relations. If interested, ask for a copy of "Employee Handbooks," by the Policyholders Service Bureau, Metropolitan Life Ins. Co.

Black Light

Invisible black light is said to be a boon to night and blind flying. This light consists of long wave ultra violet ray radiation, 99 per cent free of visible light, according to S. L. Hibbens of Westinghouse Lamp Co. It is produced by two new black bulb lamps of special cobalt glass, one consuming two amp., the other five. The effect of the rays is to increase the

luminescence of radium paint many times. Thus the instrument board may be made plainly visible without the attendant glare. Pilots may now sit in total darkness and observe ground signals and airway beacons without the usual conflicting glare of instrument lights.

Try Halowax

Understand that Halowax is another product that we can add to our list of synthetic engineering materials. It is a wax-like substance possessing several unusual characteristics. Applied to wood or metal, it affords protection against corrosion. It has flame extinguishing properties and thus may be used to protect wiring harness and fibrous materials from fire hazard. May be used as a plasticizer for natural gums, synthetic resins, etc. Has high melting point, low volatility, does not oxidize. Have you a problem in your home?

Cuts Glare

NO-GLARE seems to be something that many plant managers may like to investigate. It's a liquid glass coating which, when applied to windows, is said to eliminate the heat and glare of direct sunlight. The coating is weather-proof, but easily removed.

Achievement, 1932

Despite the turn of events in 1932, Westinghouse made a proud record in new developments for the year. The high spots were briefed in a booklet which reached our desk several days ago. Take dynamometers, for example. The eight-cylinder Ford demanded a rating

of 100 hp. at 5000 r.p.m., 11,000 f.p.m. on the commutator. Naval aircraft needed an A. C. machine which would develop about 2000 hp. And so on. Other developments of interest to us were: new industrial heating furnace equipment, instruments, special motors for machine tools, a résumé of industrial phototube progress.

Watts More

Water is cheaper than watts, claims Mr. S. G. Hibben of Westinghouse. So he recommends a general house cleaning at regular intervals. It's remarkable how the efficiency of plant lighting goes up when the lamps and reflectors are cleaned. Water will do it. But of equal importance is the matter of good reflection from walls and ceilings. Clean, well-painted surfaces yield unexpected returns in economy. When painting, choose pleasing color combinations and the color values that give the best reflection. You'll find it costs no more, but my! what a return on the investment.

Reveals Anatomy

A two-reel film showing the various metals and alloys used in the construction of engine and chassis is offered by the U. S. Bureau of Mines. It's an educational film giving the ABC's of materials and the reason for putting them where they are. Should appeal to everybody in the automotive industry. We vote it as a good show to put on at any S.A.E. or service association meeting. If you want it, apply to the Pittsburgh Experiment Station, U. S. Bureau of Mines, Pittsburgh, Pa. The title, "The Metals of a Motor Car." Available in 16 or 35 mm. size. No charge except for transportation.—J. G.

MANUFACTURING
MANAGEMENT
METALLURGY

The Forum

free to buy on price within the range of those parts manufacturers who are approved and the added quality in your own product has, therefore, no appeal.

The doubtful practices which I have spoken of above, are of such a type that if the management knew the details of these practices they would probably not approve them, but at the same time it is part of management to know that when they drive the purchasing department very hard they should also check up on the methods by which they secure results.

sell its car for a lower price, although in a good many instances the actual reduction in the price of the car has not been as great as the price reductions and concessions that they have been able to obtain from a badly scared and harried supplier.

There is no question but what if parts makers remain in business, they are going to have to receive more money for their product. The prices on parts have come so close to the price of raw material and direct labor that there is no room for carrying charges, dividends or a living wage to the employee.

While the supplier has contributed a certain amount to this condition by being weakkneed and permitting some of this to happen, the big re-



This week the Forum is devoted to excerpts from the many comments received by *Automotive Industries* on the above article. A perusal of these interesting and pointed comments makes it clear that the suppliers recognize that they are not without responsibility for the present price situation. It also emphasizes the necessity for more sympathetic relationships between suppliers and their customers, and the need for a greater degree of cooperation if the best interests of the industry are to be served.

If Management Knew

I HAVE felt for a long time that sooner or later the car manufacturers would somehow or other feel the reaction caused by the very severe conditions which they have imposed on the parts maker and indeed some of the practices which have been resorted to by very prominent car manufacturers within the past three months are almost startling when it is realized that the car manufacturing business is really a respectable business. The car manufacturer, of course, may feel that he himself is put under heavy pressure and must pass it along to the parts maker, but at least in the case of our product, we do not have the advantage of supplying a material which has a personal appeal—one car manufacturer may beat the other car manufacturer to it by presenting a more beautiful model and in that way get his price, but we can't do that for the reason that while we may make an article of superior quality it does not require any eye appeal and furthermore, an engineer is practically compelled to approve the product of two or three competing parts makers so that by the time the purchasing agent receives his requisitions he is perfectly

Must Have Money to Buy

PRODUCERS of parts requiring steel are especially in bad shape, owing to the fact that they have been ground between a more or less successful effort on the part of steel manufacturers to hold their steel prices and a continued pressure on the part of the automotive buyer to make a lower price on the parts.

The result has been a price drop on the parts made of steel way beyond the price drop in the raw material and it has only to come from one place, namely, from the worker, whether he be in the office, or in the plant and out of the pockets of the stockholders.

This brings us to another phase of the situation existing and it occurred to us might be touched on in your magazine, namely, that the automobile industry is continually trying to

sponsibility lies with the buyer, and in a good many instances, the actual purchasing agent is not to blame as he recognizes this condition, but he is given orders by the automobile executive to buy his materials at ten, fifteen or twenty per cent less and it would seem that the automobile executives would wake up to the fact that he may be getting a 15 per cent lower price on his part, but he is affecting the volume of his finished car sales untold amounts which might more than offset this supposed saving in price.

It does not make any difference how cheap the automobile builder makes his car, if people have not the money to buy it with a matter of \$50 or \$100 on the price of the car is immaterial and this \$50 or \$100 on the price of the car properly distributed might be the difference between life and death of the parts producer and the difference between whether his employees and stockholders bought automobiles or whether they didn't.

Parts Makers Lead the Way Down

YOUR word picture of the parts making situation is definite and correct. We here have discussed most all of the phases you mention, and have done our best to fight for profitable prices, not only for the sake of our employees but our treasury as well.

It is particularly true of our particular line that the automotive buyer does not have to go after lower prices. They are continually being handed to him. I have in mind an account that we enjoyed for a number of years. Today we put in our quotations regularly only as a matter of form, not expecting to receive the business because other prices are being made that are below our costs. We prefer not to have the business merely to make overhead or at a loss. We find that some competitors in these days of stress are leaning very much to the idea of direct labor and overhead in the vain hope that they will reduce the already overwhelming overhead.

I was talking over this very situation with an automotive buyer in Detroit while on a visit there last week. At the present time, 453 items of purchase pass through his hands. I asked him on how many of these items he had to knock the price down. He said in the last two years he had had to knock none down. The reductions which over one year and a half have been tremendous, have been forced by some parts maker leading the way down. I have known this man for a number of years and have every reason to believe that he was telling me the truth.

Starving on a Pile of Gold

OF course, as Mr. Denham points out, parts makers are to some extent responsible, but in the absence of it being legal to protect each other through trade associations, the parts maker is generally at the mercy of the large automobile manufacturer, who may employ unscrupulous or at least questionable methods to get his price down.

This evil is not confined to the automotive industry but runs the whole gamut of business, and to my mind is one of the real economic problems of the day. I am hopeful that out of

this depression there will come a recognition by the leaders of big business that since mass production depends on mass buying, it is killing the goose that lays the golden egg when close buying is carried to a point that makes the payment to labor an unfair wage based on living conditions. As a result, the large manufacturing corporation with its large item of cash is somewhat in the position of a man starving to death while sitting on a pile of gold.

Who Pays for Increasing Values?

AN orchid to you and another to Mr. Denham for the excellent article "On the Spot" in *Automotive Industries*. I am sure that every parts maker will sincerely thank you for the honest and courageous description of the situation which is fundamentally wrong and which must surely be corrected before the industry can regain a stable condition.

The motor car industry has long pointed with pride to the great and increasing value offered the car buying public for its dollar, but, as is indicated in this article, it is quite possible that some of this value is being borne at the expense of employees, suppliers and security holders and, incidentally, the above groups constitute quite a noticeable percentage of the car buying public.

Low Prices No Bait Now

THINK you performed an excellent service in calling attention to the unwise forcing of prices to a point which permits inadequate wages to workmen and to destructively unprofitable plant operations.

I think it is fair to question the policy of vehicle manufacturers in pricing their own product on a level which invites a loss under the volume of business than can reasonably be expected during the next several months.

It seems to us that the present low volume of automobile business can be influenced very little by price reductions as the fundamental cause of low volume is lack of purchasing power. In this respect the problem is quite different from that faced by the industry in 1920 and 1921, when

low volume was due largely to a buyers' strike on account of the current high prices.

It would seem much more sound to price the products of the automobile industry on a basis which would permit operation without cash losses, so that the industry would be in sound financial condition and able to take advantage of a general resumption of purchasing power.

I quite agree that it is impossible to base selling price on a cost which includes complete absorption of all fixed overhead charges, but the industry is certainly entitled to at least a break-even on cash outgo; and the insistence upon this right will insure the opportunity to preserve a fair wage scale and to maintain a sound financial position for the future.

Puts Cards on the Table

IN my opinion, *Automotive Industries*, in taking this position, is making a very vital and courageous contribution to this industry. The conditions recited by Mr. Denham are known to everybody who has been in this business more than fifteen minutes but so far as I know, you are the first to have the courage to put the cards on the table.

Although this article may appear to present the case of the suppliers, I do not feel that its conclusions are in any way inimical to the manufacturers. Present policies will in the long run have a serious effect upon the entire industry.

Live and Let Live

congratulate you and commend your courage in calling the large automobile companies' attention to a serious situation.

I hope your article will be given thoughtful study by those at the top, many who seem to be imbued with a single idea of "drive the price down" thereby giving encouragement to cut-throat competition which never did any good for anybody including those that receive temporary benefits by this ruinous policy.

Before we will again ever enjoy prosperity and contentment we will have to return to the spirit of being willing to "live and let live."

METAL CLEANING

Methods and

by Joseph Geschelin

Engineering Editor,
Automotive Industries



METAL cleaning has witnessed a great surge of progress during the last few years not only in the development of new production methods and technique, but in the birth of new materials and new proprietary processes which are bound to exert a profound effect upon cost.

Fortunately, with the present set-up in the art of metal cleaning it is possible to meet the most rigid demand of surface quality without sacrificing cost. Nothing mysterious about the process. Simply a matter of the judicious selection of cleaning materials and technique out of the wide variety that the art affords at the present moment.

Our object is to present only the high lights of recent developments, stressing particularly the newer materials and methods now available.

From a purely economic point of view, metal cleaning presents just one problem—minimum quality of surface consistent with the nature of the process. Thus the entire matter of the selection of methods, materials and equipment hinges upon getting the desired result at the lowest cost.

Fortunately despite its com-

plexity, metal cleaning lends itself quite readily to a systematic analysis which permits us to set the problem in simple fashion. As the first step in this process we can say that metal cleaning is controlled by the following factors:

- A. Kind of work.
 - a. Machined parts such as castings, forgings, screw-machine parts, etc., which are to be cleaned in process or at the final operation.
 - b. Small stampings in process or at the final operation.
- B. Kind of material.
 - a. Cast iron, steel, brass, aluminum, copper, zinc.
- C. Required to remove.
 - a. Oil, grease, cutting compound, quenching oils, dirt.
 - b. Rust, scale, oxide.
- D. Metal surface prepared for—
 - a. Electroplating
 - b. Enamel, lacquer, paint, japan.
 - c. For further process such as grinding, machining, etc.
 - d. For stock or assembly, per-

haps with some anti-rusting requirement.

Having thus isolated the elements of the general metal cleaning problem, the next step is to set down the available materials and methods and then study their particular application as follows:

- 1. Alkaline preparations.
- 2. Pickling.
- 3. Degreasing by means of organic solvents.
- 4. Electrolytic methods — acid and alkaline bath.
- 5. Electrolytic bright dip.
- 6. Bullard-Dunn process.
- 7. Cleaning tanks and rinses hand operated or mechanized by means of conveyors.
- 8. Metal washing machines.

The process of selection depends entirely upon the field of application of the cleaning material and technique within the requirements outlined as A, B, C, D. The selection of equipment, on the other hand, depends upon the volume of production.

Now for the application and

Materials

Part I

A Comprehensive Study of the Latest Developments in This Important Field

the general sphere of usefulness of the materials and processes outlined above.

1. **ALKALINE** cleaning is probably one of the oldest and most commonly used method for the general run of metal cleaning where it is required to remove oils, greases, fats, dirt, etc. It does not remove scale or oxide. Because modern production implies the removal of various types of materials from the work, and in varying proportions, most of the alkaline materials are compounded of different ingredients in proportions demanded by the nature of the work to be done.

The selection of the alkaline preparation will be better understood if we consider the functions of its ingredients, usually alkali and emulsifier.

ALKALI PROPERTIES

a. Saponification:

Alkalies have the property of neutralizing fatty acids, thereby making soaps.

b. Wetting Power:

The addition of an alkali to water reduces the surface tension of water and gives it better penetrating power.

c. Electrolytic Conductivity:

The addition of alkalies to an aqueous solution gives it the property of conducting electricity. In an electrolytic cleaner, the agitation, caused by the emission of gases at the electrodes, helps to

loosen the dirt and promote emulsification.

d. Water Softening:

The addition of an alkali to hard water precipitates the dissolved calcium and magnesium compounds as insoluble salts. The amount of alkali thus consumed depends upon the degree of hardness of the water.

The properties of the *emulsifiers* are as follows:

a. Emulsification:

Emulsification is the uniting, in the form of a very fine mechanical mixture, of oil and water; any material which is soluble in both is

an emulsifier and will unite them.

b. Colloidal Suspension:

This is a property of colloidal substances to envelop small particles or inert material and thereby carry them in solution.

c. Deflocculation:

There is a tendency for small particles of inert materials in solution to gather and stick together. Dirt removed from one part of a piece of metal will build upon another part. A strong colloidal enveloped around each small piece of inert material will prevent this action.

d. Free Rinsing:

To be free rinsing, the solution must hold its dirt and oil load even when diluted to many times its original volume with water. In the rinse tank, that portion of the cleaning solution adhering to the metal must float off with its complete load and leave the surface chemically clean.

How the functions outlined above are related to the cleaning process is made clear by the following considerations, if we assume a typical case of achieving a chemically clean surface. To remove:

a. Mineral oil requires a process of emulsification. That is, the cleaner must have good emulsifying properties.

b. Animal and vegetable oils require saponification. This brings into play the alkali ingredient which, by chemical action, converts the oils and fats into alkaline soap soluble in water.

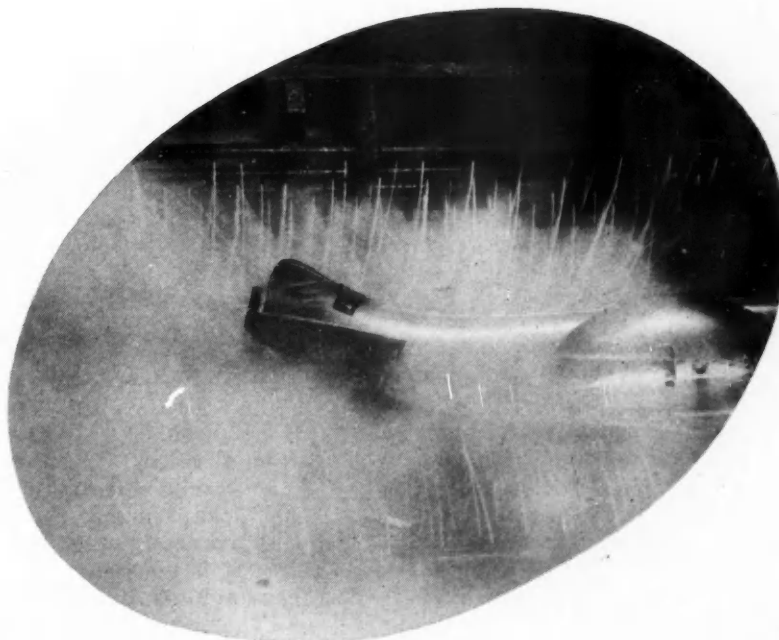


Table 1 List of Supplies of Metal Cleaning Preparations
(From Automotive Industrial Red Book)

Allied Industrial Products Co., 17 W. Elizabeth St., Chicago, Ill.	International Chemical Co., 2628 N. Mascher St., Philadelphia, Pa.
American Chemical Paint Co., Brookside Ave. & Reading R. R., Ambler, Pa.	Lake Erie Mfg. Co., 192-98 Chicago St., Buffalo, N. Y.
Blakeslee & Co., G. S., 1900 S. 52nd St., Cicero, Ill.	Magnus Chemical Co., Garwood, N. J.
Bruce Products Corp., 5712 12th St., Detroit, Mich.	Magnuson Products Corp., 55 Third St., Brooklyn, N. Y.
Buchanan Chemical Co., C. G., Baker Rd., Cincinnati, Ohio.	Michiana Products Corp., Sheet Steel Products Division, Michigan City, Ind.
Dearborn Chemical Co., 310 S. Michigan Ave., Chicago, Ill.	Oakite Products, Inc., 22 Thames St., New York, N. Y.
Ford Co., J. B., Wyandotte, Mich.	Park Chemical Co., Military & Vancouver Aves., Detroit, Mich.
Hanson-Van Winkle-Munning Co., Matawan, N. J.	Quigley Co., 56 W. 45th St., New York, N. Y.
Houghton & Co., E. F., 240 W. Somerset St., Philadelphia, Pa.	Rex Products & Mfg. Co., 13005 Hillview Ave., Detroit, Mich.
Industrial Chemical Products Co., 6540 Sylvester St., Detroit, Mich.	Rhodes & Co., James H., 153-59 W. Austin Ave., Chicago, Ill.

c. When mixtures of (a) and (b) are present, and this of course is a common occurrence, the cleaner must have both emulsifying and saponifying properties.

d. Carbonized dried oils and high capacity oils, it is necessary to use a preparation having great wetting out or lifting property. This involves the property of defloculation noted above.

Further restriction is placed upon the selection of an alkaline preparation by the nature of the material to be cleaned. This does not apply to iron or steel parts since they are relatively impervious to attack, but is of great importance where non-ferrous metals and their alloys are concerned.

In this connection the following procedure recommended for aluminum is taken from *Automotive Industries*:*

"The metal is first cleaned of any dirt or grease with a mild alkaline cleaner or solvent, and then rinsed in clear, cold water. The surface is then made uniformly active by a dip of from 5 to 30 seconds in a solution of 1 part of 50 per cent hydrofluoric acid with nine parts of water. In case an acid dip is to follow, this preliminary dip is elimi-

nated. The surface is next roughened by etching, rinsed in clear, cold water, then transferred to the plating bath.

"The cleaning process accomplishes a dual purpose. It removes all dirt and grease from the surface and also helps to dissolve a greater portion of the oxide film which covers the aluminum. With ordinary metals it is customary to use strong alkaline cleaners to dissolve the dirt and grease. These are often too strong for use with aluminum, as they have a tendency to attack the metal. In place of these a mild alkaline cleaner is recommended, containing small amounts of sodium carbonate and tri-sodium phosphate in equal quantities of 1 to 3 ounces to a gallon of water, applied hot at 180 deg. to 200 deg. Fahr. Such a mixture attacks the aluminum mildly in about the same manner as an "electric" cleaning.

Finally, the cost of the metal cleaning job is greatly affected by the rinsing requirement. Thus in the preparation of the metal surface for electroplating, pickling, lacquering, etc., it is necessary to remove all traces of soap and alkali, demanding essentially, a chemically clean surface. However, where parts are in process of manufacture, it is generally permissible to leave a light film of alkali and soap. The same is true of ferrous

parts which are prepared for stock and require temporary protection against corrosion.

2. PICKLING is the process required for the removal of scale and rust and consists of treating metals with dilute acid solution. Now it has been found that the scales are usually iron oxides of the following types: a. Hydrated ferric oxide—ordinary brown rust. b. Anhydrous ferric oxide—similar to brown rust but is formed in the absence of water. c. Magnetic oxide or black scale formed in hot working operations.

Since the latter two types of oxide are usually present, and since both are only slightly soluble in pickling acid, it is apparent that the mechanism of pickling is to peel off the scale rather than dissolve it.

It is claimed by some investigators that the black magnetic oxide can be removed in the pickle only by the dissolving of the steel under it, thus freeing the scale so it will fall off. It is also claimed the fine particles of the oxide are often deeply imbedded in the surface of the steel and the ordinary pickling action fails to remove them. Spots of this kind are sometimes termed "black," and "blacks" being hard and tenacious with the effect of dulling the edges of cutting tools where machining is required. In electroplating it is found that these "blacks," if

*"Electroplating Aluminum on Production Basis" by W. S. McArdle, *Automotive Industries*, January 16, 1932.

remaining after the pickle, prevent the proper adherence of the electroplate and eventually permit corrosion to start.

Since the acid used in the pickling process will readily attack steel parts, some form of inhibitor is used to retard the action of the acid. Although the function of an inhibitor is complex from a chemical point of view, it is said that the inhibiting compound is deposited most heavily where the tendency toward solution is strongest. Thus the deposit is heavy on the clean metal surface, around slag inclusions and other irregularities, but much less heavy on areas still coated with scale. As these colloidal deposits retard solution of the metal, action is slowed down where it is not needed and is permitted to take place rapidly where it is needed.

3. METAL DEGREASING by the use of organic solvents has attracted considerable attention recently, especially in the cleaning of parts for electroplating, lacquering and painting where a chemically clean surface is essential. Two methods of organic solvent degreasing are in common use today, liquid phase and vapor phase.

Vapor phase degreasing appears to have achieved its greatest popularity, particularly in large scale production. In this method the vapors condense immediately on contact and flow off carrying away the grease and grit. Usually a shield or large mass of metal is placed on the hook above the part being cleaned to cause a flow of freshly condensed solvent to play over the entire surface of the greasy work. A suitable condensing arrangement is required within the cleaning tank either on its upper walls or in the cover to provide for vapor which rises above the parts being cleaned.

Because of the high boiling point of the liquid, the metal to be cleaned is heated, the grease softened, dissolved and removed in a very short time. The basket or hook containing the parts being cleaned is timed in its transit through the vapor compartment so as to emerge with a properly cleaned article. In many cases the parts leave the cleaning tank, enter another chamber where they are heated so as to drive off any solvent remaining on the metal.

The claim made by those specializing with solvent degreasing systems is that the solvent action is so penetrating that it removes all traces of gritty particles, abrasives, buffing compounds, etc. Naturally, this is of utmost importance where

the parts are being prepared for electroplating and finishing.

4. ELECTROLYTIC methods of cleaning metal have found wide application in industry, particularly in large quantity production. The advantages of cleaning metals with the aid of electric current are claimed to be:

- a. Saving in time.
- b. Caked-on deposits dislodged by mechanical action.
- c. Tarnishing is diminished on non-ferrous metals.
- d. Lower concentrations of cleaning solutions.
- e. Carbon smut sometimes removed from steel.
- f. Possible combination of electric cleaning and electroplating in one solution.

The equipment for, and the operation of electrolytic cleaners are much the same as for electroplating except that no metal is deposited and the current may be reversed in direction. The electrolytic bath may be either alkaline or acid solution, depending upon the nature of the materials being removed from the work. Consequently, the commercially available alkaline preparations and pickling compounds may be used in the process, the only difference being that generally a lower concentration is possible.

As in the case of still-tank cleaning, a pickling bath for the removal of scale and oxide must be preceded by an alkaline bath if the work is also covered with oils, fats and greases.

Stated simply, the requirements of a cleaning solution for an electrolytic bath are as follows:

- a. Good electrolyte.

- b. Free rinsing.

- c. Free from chloride, sulphate and metal hydroxide.

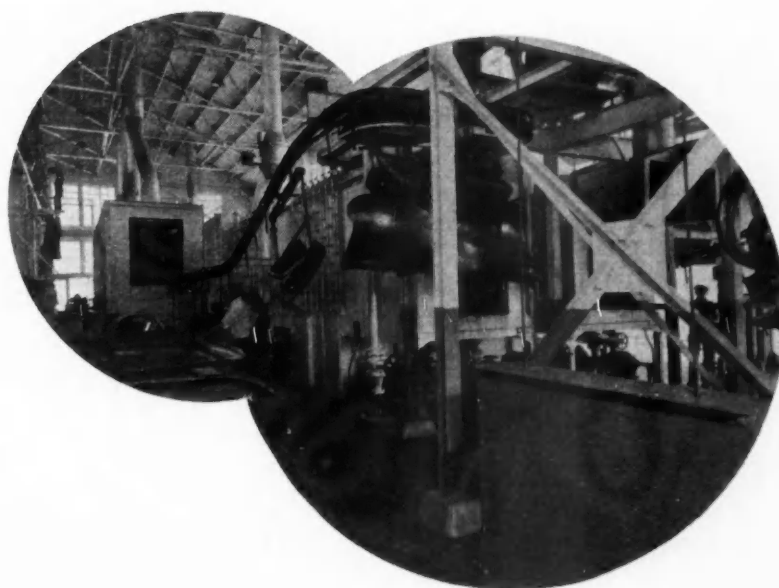
- d. Must be an efficient still-tank cleaner in order quickly to put into solution the oils and dirt lifted by the gas.

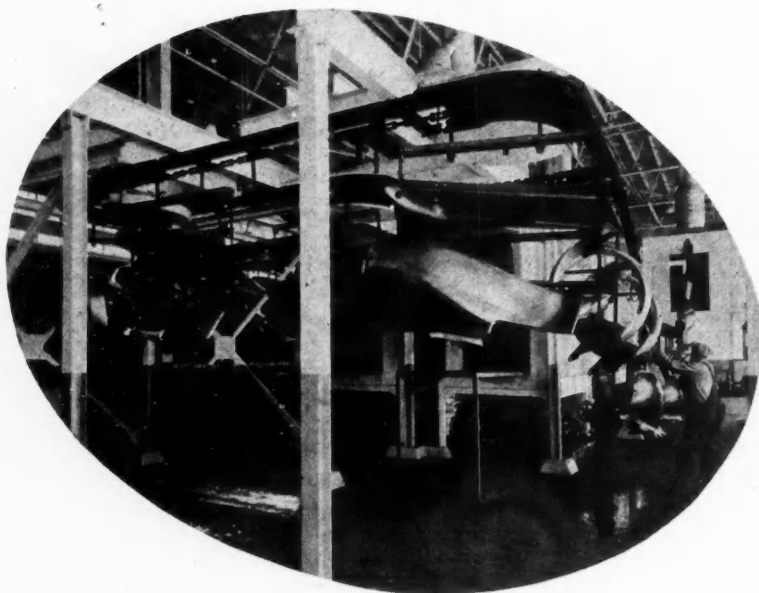
5 and 6, the Bullard-Dunn as well as the Electrolytic bright-dip process are special electrolytic processes which will be discussed more in detail in Part 2 of this study.

7. There is no space in this study except for a brief mention of the still-tank and rinsing equipment essential to a good metal cleaning job. Obviously, the design of the metal cleaning equipment depends entirely upon local conditions as well as the volume of production involved. Broadly speaking, hand-operated equipment is sufficient for all small quantity requirements, whereas continuous production is handled much more economically by mechanized, still-tank equipment in which the work is carried through on a conveyor.

Authorities in the field of metal cleaning point out the fact that proper rinsing is easily as important as the primary operation of metal cleaning. Thus alkalies should be rinsed prior to an acid bath to prevent neutralization and change of the chemical composition of the acid bath. Acids should be rinsed prior to an alkali bath to prevent neutralization and change of the chemical composition of the alkali bath. By the same token, alkalis should be rinsed prior to subsequent alkali baths to prevent change in the chemical composition of the second bath.

The work should not be allowed





to dry in the atmosphere between operations where the metal is being prepared for electroplating. If there is a tie-up in production, work should be kept in a cold rinse tank until ready for the next operation.

8. METAL WASHING MACHINES are used wherever a reasonably large volume of work is to be cleaned or where it is necessary to clean parts which would nest badly in baskets or in the case of work which is difficult to rack in the still tank. The market abounds in many forms and varieties of washing machines to suit practically any condition that may come up in the automotive plant. The scope of the washing machine has been greatly extended by the recent introduction of degreasing machines utilizing organic solvents.

Among the applications of washing machines are the following:

- a. For cleaning metal stampings prior to japanning, enameling or finishing operations.
- b. For removing excess oil and chips on machined or stamped parts prior to assembly.
- c. As a preliminary operation for the removal of chips and excess oil prior to tank cleaning in preparation for plating or vitrious enameling.
- d. Cleaning and applying a rust-preventative spray in one operation.

As a rule, the metal washing machine is very economical in the consumption of cleaning solution and the volume of solution required is much less than would be necessary to handle an equivalent amount of work in still tanks. Metal washing

machines can be arranged to wash the work without rinsing, thereby leaving a slight soapy film as a temporary rust preventive. Or, they can be equipped with a rinsing unit.

Some machines are designed to handle an entire chain of operations including cleaning, rinsing and drying.

As in the case of aluminum, zinc requires "pre-treatment," i. e., some process of preparation other than the mere removal of foreign matter from the surface. The following procedure is recommended by the New Jersey Zinc Co. in the preparation of zinc and zinc alloy parts for electroplating or lacquering and enameling:

"1. Mechanical Cleaning. This method is recommended wherever it is feasible to carry out such an operation. Results favor the use of relatively fine material, although the optimum particle size of grit or sand for blasting has not been determined.

"2. Simple Immersion Cleaner. An example of such a cleaning solution is given below:
15-60 grams/L or 2-6 ozs./gal. Tri-sodium Phosphate
2-8 grams/L or 0.25-1.0 ozs./gal. Sodium Hydroxide

Articles should be immersed for one minute at a temperature of 70-80 deg. C. (160-175 deg. F.)

"The point of weakness in this method of cleaning is the fact that it is almost certain to leave a thin film of alkaline salts on the surface of the metal. This film, however, may be completely removed by immersing the article for a few seconds either in a 10 per cent solution of hydrochloric acid (Sp. Gr. 1.18)

or a 1 per cent solution of 5 per cent hydrofluoric acid. This, of course, is followed by a thorough rinsing in clean, hot water.

"3. Electro Cleaning. A widely used solution is one containing six ounces of tri-sodium phosphate per gallon of water, maintained almost boiling hot while the article is made the cathode with a voltage that will cause violent gasing. One-half to two minutes, depending on the amount of grease and oil present, is sufficient for thorough cleaning. The cleaning solution can be removed by alternate rinsing in hot and cold water.

"4. Solvent Cleaners. It is safe to say that very effective cleaning can be accomplished with such volatile solvents as ethyl acetate, carbon tetrachloride, xylol, etc. However, the success of this method depends largely upon the choice of the solvent and upon the care with which the operation is carried out.

"5. Mechanical and Chemical Roughening of Surface. Since the service requirements of articles finished with lacquers and enamels are usually quite severe, pre-treatment of the metal surface to improve adhesion is often resorted to in addition to the cleaning methods mentioned above, especially in the case of very smooth sheet products.

a. Mechanical Roughening.

Blasting (with metal grit or sand) is very effective.

b. Chemical Roughening.

In the case of acid etches, the metal should be cleaned first, since greasy areas may resist attack by the acid."

The foregoing is intended to give in a rather sketchy fashion simply the high spots of the modern, metal cleaning problem and also some idea of the materials and methods commercially available. Although it may sound elementary to the production executive, much of the success of metal cleaning depends upon a thorough and competent analysis of the problem along the lines suggested in this article. In fact, our chief object of developing the discussion in this fashion is to show how the judicious selection of materials and methods can be reflected not only in the quality of the work, but also in a reduction of the overall production costs in the metal cleaning department.

Part 2 of this study of metal cleaning, to be published in an early issue of *Automotive Industries*, will describe in detail the chief features of some of the newer metal cleaning preparations, equipment, and special proprietary processes.

Arched Front Axle a Novel Feature of New Coleman Car

THE illustrations herewith are of a new passenger car that has been built by Coleman Motors Corporation of Littleton, Colo., from designs by H. R. Holmes. One of the chassis features is a patented arched front axle, which permits of placing the engine 16 in. farther forward than would be possible with a straight axle, and also 4 in. lower. This, of course, adds to the passenger room available and also facilitates streamlining of the body.

Moving of the engine ahead brings the rear seats well forward of the rear axle, thus improving their riding qualities. The floor is 5 in. below the wheel axis, which reduces side sway at high speeds. There is a door in the rear of the body which gives access to both the spare tire and the baggage compartment from the ground, but the baggage compartment is accessible also from the inside. The fuel tank is located at the rear below the spare tire and can be filled through the opening of the large door, which is locked from the inside.

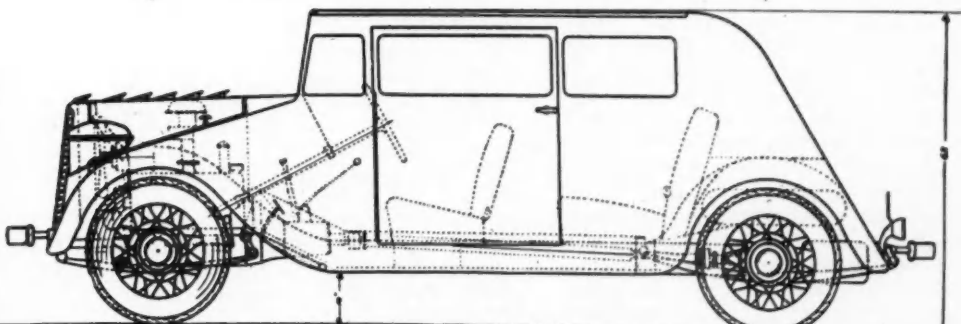
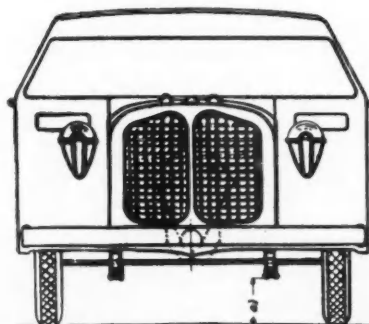
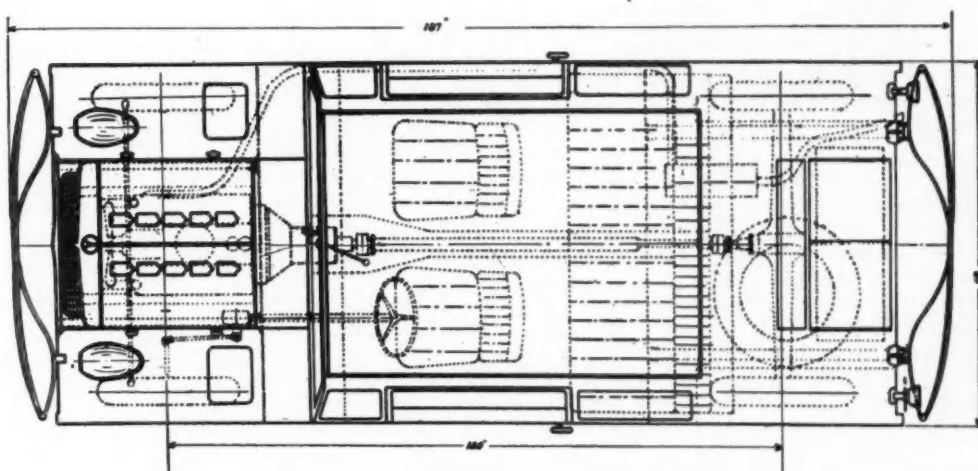
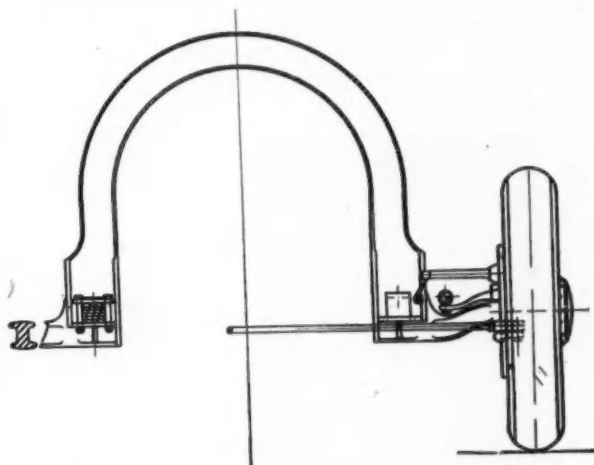
Chassis components include the 1933 Ford engine, transmission and rear axle assembly, together with wheels. The weight of the car is 2950 lb. For the present it is built on order only, the price being \$1000. It is hoped to get on a regular production basis shortly.

Plan view, front and side elevations, showing the general design of the Coleman car



Three - quarter side view of the Coleman streamlined car made in Colorado

Arched front axle of Coleman car which permits of low suspension of powerplant



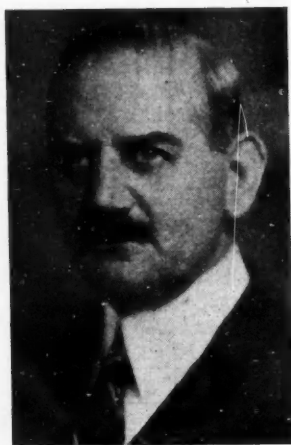
Moderately Higher Prices Industry's Greatest Current Need, Reeves Says

Reports Strong Upswing in Sales But Finds Prices Out of Line With Quality and Probable 1933 Sales—Expects Improvement in Business Generally by June

NEW YORK—"The figures for retail sales of cars and trucks made during the last three weeks will prove something of a pleasant surprise when the results are finally tabulated," declared Alfred Reeves, vice-president of the National Automobile Chamber of Commerce Tuesday of this week, upon his return from a trip through the middle west where he visited leading automobile factories and dealers.

The greatest current need of the automobile industry, in Mr. Reeves' opinion, is a general increase in prices which will enable manufacturers and dealers to lessen the operating losses which they are suffering.

"In recent weeks we have witnessed a substantial improvement in the market for both passenger cars and trucks



Alfred Reeves

which gives promise of hastening the industry's recovery from the injuries caused by the unfortunate bank closings," said Mr. Reeves.

"While this improvement is taking place much more rapidly among companies manufacturing the lower priced cars, sales of the medium and higher priced units also indicate an encouraging improvement."

A moderate upward revision in automobile prices would have a most wholesome effect on both the manufacturing and distributing divisions of the industry, Mr. Reeves believes.

"Car prices are undoubtedly too low for the quality of products which our industry is offering the public. They are so low that we do not believe the general public would consider a general upward readjustment as anything but perfectly normal and proper."

According to the Chamber executive, current car prices were fixed prior to the introduction of new mod-

els several months ago and were based on an anticipated market volume which subsequent developments, particularly the effect of the banking situation, have made improbable of achievement during the balance of the year.

"Despite the aggressive sales and advertising campaigns with which the motor industry has supported the introduction of these new cars, prices have been found to be too low for both manufacturers and dealers, and an increase of from 5 to 10 per cent would be necessary to bring most cars in line with production costs," he added.

"As conditions throughout the country become more favorable with the encouraging program that President Roosevelt and the Administration in Washington is making with our major problems, the buying of cars and other commodities as well will surely expand. By the end of June we expect that the whole business picture, both international and domestic, will have improved so definitely that it will have the wholehearted support of everyone, even those who until the present time have shunned the 'band wagon'—waiting for further reassurance from the commodity and security markets."

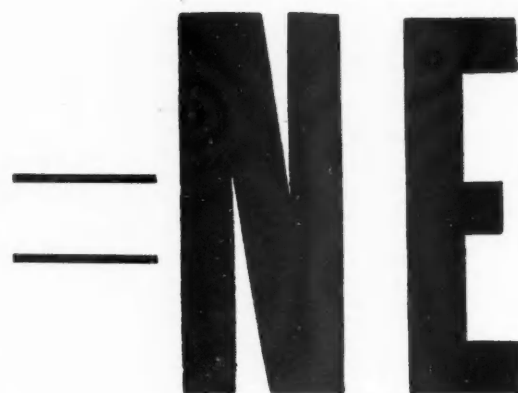
Nash Reports First Quarterly Deficit

KENOSHA, WIS.—Nash Motors reports a net loss of \$134,136 for the quarter ending Feb. 28, 1933, after depreciation and taxes. Payment of the regular quarterly dividend of 25 cents a share has been deferred. In the corresponding quarter a year ago, net income was \$211,927. The deficit reported here represents the first time the company has reported red figures for any quarter.

Cash and marketable securities as of Feb. 28, 1933, amounted to \$31,503,668 against \$32,134,277 three months earlier at the end of the fiscal year. Dividends of approximately \$660,000 were paid during the quarter, which total is slightly more than the decline in cash and its equivalent. Assuming depreciation was charged off at the 1932 rate, the first quarter deficit was less than the depreciation charge.

L-O-F First Quarter Profit

TOLEDO—Libby-Owens-Ford Glass Co. showed a net profit of \$623,103 for the first quarter of 1933 against a net of \$44,230 in the same period last year.



Administration O.K's 30-Hr. Work Week Idea

Dangerous Bill to Rush Through, Macauley Says

WASHINGTON, D. C.—Chances for the final enactment of the 30-hr. week bill passed by the Senate, have been greatly improved by Secretary Labor Perkins' approval of the principle of the bill. In view of the doubtful constitutionality of the proposed legislation, however, it is quite possible that real opposition to it will be delayed until a test case can be brought before the Supreme Court.

"Although my judgment on the 30-hour-work week bill is by no means mature," Alvan Macauley, president of Packard and of the N.A.C.C., said in commenting on the bill, "I believe it is a dangerous piece of legislation to rush through. The overhead of a modern industrial plant involves at least several million dollars annually, and the bill proposes to limit the use of that overhead by curtailing hours of work. Such action should result only through careful consideration of its consequences to industry. I believe the bill is gravely dangerous at this time, and that it might result in a great increase in the production costs and in the prices of manufactured articles."

(Turn to page 476, please)

G. M. Gets Tax Refund

WASHINGTON—Taxes and interest totaling \$2,067,000 for 1922 and 1923 have been abated to the General Motors Corp. and its subsidiaries by the Treasury Department for over-assessment.

Canadian Ford Loss

DETROIT—Report of Ford Motor Co. of Canada, Ltd., for 1932 show a reduction in surplus account of \$6,206,736 consisting of an operating loss of \$5,206,736 and \$1,000,000 transferred to a reserve for investment in affiliated companies and contingencies.

WS

Pierce-Arrow Elects Chanter President

Has Been Vice-President and General Manager Since 1928

BUFFALO—Arthur J. Chanter, who since August, 1928, has actively managed The Pierce-Arrow Motor Car Co. as first vice-president and general manager, has been elected president of the company, succeeding A. R. Erskine, who was reelected chairman of the board.

The directors also reelected Burton H. Warner, vice-president in charge of manufacturing, Roy H. Faulkner,



Arthur J. Chanter

vice-president in charge of sales, M. C. Ewald, treasurer and secretary.

Under Mr. Chanter's management during the past five years, the Pierce-Arrow company has steadily improved its position until its annual share of the country's fine-car sales is more than double the 1928 proportion.

Pierce-Arrow's new president has been associated with the automobile industry for more than 20 years. In an executive capacity, his experience has embraced at various periods the manufacturing, engineering, sales and accounting phases of the business.

Production Expands as Sales Reports Indicate 40% Gain in April over March

Preliminary Estimates Put March Car Sales at 77,000, or 10% Ahead of February—Current Deliveries Running Well Above a Year Ago

DETROIT—From such figures as are available to date, it is estimated March automobile sales totaled about 77,000, an increase of better than 10 per cent over February. The closing week accounted for more than 30 per cent of the month's sales.

Judging from present trends it is easily possible that April retail sales will exceed 120,000 compared with 117,000 last year. Uncertainty as to correct interpretation of the present bulge in sales makes accurate prediction difficult. April, however, should be at least 40 per cent above March. At present retail deliveries are running well in excess of sales at same time last year, but it is more generally assumed that delayed buying from early last month may still account for

much of the recent sales increase.

Nevertheless, production schedules for April have been increased in almost every case beyond original estimates as of March 15 to supply current demand. Sales estimates for the year which last month were quoted at around 750,000 have been boosted to an average estimate of 900,000 with some in excess of this figure.

On the basis of partial returns Chevrolet still leads the field in March with an estimated 24,400; Ford was second with 20,600 and Plymouth third with 10,400 new passenger car registrations. As compared with March, 1932, Chevrolet shows a decline of about 18 per cent, Ford a gain of 162 per cent and Plymouth a gain of 85 per cent.

William E. Metzger, Automotive Pioneer

DETROIT.—W. E. Metzger, vice-president of the Federal Motor Truck Co., a director of the National Automobile Chamber of Commerce and one of the industry's real pioneers, died Tuesday of this week following a long illness. He is credited with having operated the first automobile store in 1899, was a factor in the management of the first automobile show held in the old Madison Square Garden, New York, and was also the "M" in the old E. M. F. company which subsequently was absorbed by Studebaker.

After a preliminary training as a bicycle dealer and salesman for typewriters and cash registers, Mr. Metzger entered the automobile field as a dealer selling a line of electrics. The success of the Olds gasoline car con-

(Turn to page 477, please)

munities. Plymouth registered 268 and Pontiac 235. Total registrations were 3,284. Commercial registrations of 319 contrasted new car sales by an increase of 7 per cent compared with February, although lagging behind last March by 45 per cent. Here also smaller communities showed better proportionate sales.

Reo in Production on "Revolutionary" Device

Announcement of Details Withheld Until Dealers Have Ample Inventories

LANSING, MICH.—R. H. Scott, president and general manager of the Reo Motor Car Co., announced this week that an automotive improvement of revolutionary character ranking in importance with the self starter has been put into production by Reo and will be announced to the public within thirty days. Full details are being withheld until dealers throughout the country have been amply stocked. The invention is said to be one engineers have long predicted and is regarded as a major step toward simplification of automobile operation. The new Reo device is the invention of H. T. Thomas, chief engineer, and his corps of assistants. The device is said to have been tested thoroughly during the past two years in all parts of the country and is now termed fool-proof. Reo dealers have visited factory lately in large numbers and recently orders have more than doubled in anticipation of spirited demand for the new product when announced.

Bank Troubles Reduce Michigan March Sales

DETROIT—Michigan new car registrations for March showed a drop of 19 per cent as compared with February and 24 per cent compared with March of last year. Sales in smaller communities have not been affected as heavily as in Detroit. Compared with last March the figure shows decreases of 33 and 12 per cent respectively. Chevrolet remained in first place with 1,013. Ford, with 990 out-sold Chevrolet in Wayne county, but remained far behind in smaller com-

Business in Brief

Written by the Guaranty Trust Co., New York, exclusively for Automotive Industries

There was a pronounced improvement in general business last week as the effects of the banking holiday became less apparent and confidence increased. The legalization of beer has opened a wide field for industry and taxation, and much is expected of the psychological influences of the peak activity in some lines that has been necessary to meet the demand for the beverage.

Freight Loadings Jump

Railway freight loadings during the week ended April 1 totaled 494,588 cars, which marks an increase of 18,738 cars above those during the preceding week, but a decrease of 50,373 cars below those a year ago and a decrease of 233,246 cars below those two years ago.

The Shippers' Advisory Boards have estimated that railway freight loadings during the second quarter of this year will be .3 of one per cent less than those in the corresponding period last year.

Retail Sales Slow

Department store sales in the metropolitan area of New York during the first half of March, according to the Federal Reserve Bank of New York, were 24 per cent below those in the corresponding period last year.

Deficits

The Federal Reserve Bank of New York reported that the annual statements of 758 mercantile and industrial concerns indicate an aggregate deficit of \$10,000,000 for 1932, which compares with a net profit of \$668,000,000 for the same companies for 1931 and one of \$2,898,000,000 for 1929.

Crude Oil Production

Average daily crude oil production for the week ended April 1, amounted to 2,239,750 barrels, as compared with 2,249,650 barrels for the preceding week and 2,154,000 barrels a year ago.

Power Production Low

Production of electricity by the electric light and power industry in the United States during the week ended April 1 was 5.3 per cent below that a year ago, while production during the preceding week showed a decline of 6.9 per cent.

Fisher's Index

Professor Fisher's index of wholesale commodity prices during the week ended April 8, stood at 56.2, as against 56.4 the week before and 56.6 two weeks before.

Stock Market Gains

After further declines in the first part of the week, the stock market rallied strongly toward the end of last week. The level of trading increased as the rally gained strength, and most issues closed the week with net gains. The bond market, however, was generally weak, with sharp declines in German issues.

Federal Reserve Statement

The consolidated statement of the Federal Reserve banks for the week ended April 5, showed decreases of \$109,000,000 in holdings of discounted bills, of \$24,000,000 in holdings of bills bought in the open market, and of \$1,000,000 in holdings of Government securities. The reserve ratio on April 5 was 59.7 per cent, as against 57.8 per cent a week earlier and 55.5 per cent two weeks earlier.

Olds Sales Gain

DETROIT—Retail sales of Oldsmobiles during the last 10-day period of March exceeded those of the corresponding period of March, 1932, by nearly 10 per cent and represented the largest 10-day sales the company has enjoyed since April of 1932, according to R. M. W. Shaw, sales manager.

Bell Will Distribute Graham

DETROIT—Graham-Paige Motors Corp. has appointed Herbert D. Bell as distributor in the San Francisco territory. Mr. Bell has been connected with the San Francisco automobile business for the past 17 years. Headquarters of the new Graham organization will be at 1665 Van Ness Ave.

Freight Rate Cut Being Forecasted

Move to Adjust Rates to Price Level is Gaining Favor Among Rail Heads

WASHINGTON, April 6—The belief is growing that the rail lines will make a general reduction in all classes of freight rates, either by voluntarily or by Commission action. This view prevails despite the fact that the Commission only recently authorized railroads to continue surcharges until Sept. 30. Railroad executives appear to be coming more to the realization that rail rates will be compelled to take their part in the deflation along with commodity prices and wages. While there still is a strong element in the railroad industry for maintenance of rates, a greater number are turning to an opposite view.

Tied in with the question is that of proposed rail consolidation on which the Roosevelt administration is working with present indications of a coordinator being set up to supervise rail transportation. That this will be carried in impending legislation seems probable. It has been stated that the rail legislation will be offered separately and will be followed by motor vehicle regulation. Motor vehicle legislation, long pending, apparently is about to come to a head with its exact nature still a question of doubt. Chairman Rayburn of the House Committee on Interstate and Foreign Commerce is studying the bill drafted by rail, utility commissioners and certain motor carrier interests. He has not made known his position. The bill is more rigid in the way of motor regulation than the one his committee has prepared but is withholding until the administration program takes a definite shape and until the measure of the different transportation bodies has been given more careful study.

Minnesota Cuts License Fees 20 to 50 Per Cent

MINNEAPOLIS—Minnesota motorists will save from 20 to 50 per cent this year and next on automobile licenses the legislative houses having finally come to an agreement after many weeks of argument and amendments. The governor will sign the bill. The average general cut is about 42 per cent and the total some \$3,330,000 saved to car owners. All Class A cars (Ford, etc.), get 50 per cent off with \$5 minimum. New and one-year-old Class B cars are allowed 20 per cent off the present tax, and all other cars of this class 40 per cent off with \$7.50 minimum. One-ton Class T trucks will pay 40 per cent less and less than a ton 50 per cent. Final date for payment of 1933 taxes has again been extended, this time to April 30.

Drastic Regulatory and Rate Fixing Bills Fail to Pass in Most State Legislatures

Tendency Toward Lower License Fees Develops as States Seek to Increase Cars in Use to Enlarge Revenues From Taxes on Gasoline

WASHINGTON, D. C.—Provisions for more drastic regulation and the fixing of rates for contract and common carriers by motor truck have been defeated in a majority of the state legislatures in which they were offered this year.

Oregon is the sole state to join the ranks of those with drastic laws for the regulation and fixing of rates for motor trucks engaged in commercial hauling, although provisions in similar existing laws in Arizona and Indiana were extended in some measure, and private carriers by motor truck were made subject to regulation in Arizona, New Mexico and Oregon.

Measures calling for motor truck regulation and the fixing of rates and charges were defeated in Idaho, Montana, North and South Dakota, Washington, West Virginia and Wyoming.

About 5000 bills affecting motor truck operation were introduced in state legislatures this year, as compared with about 7000 in 1931. Registration fees and special taxes, exclusive of gasoline taxes, were dealt with in about 400 of the bills, and 150 others related to the size and weight of vehicles using the public highways.

The general tendency to reduce registration fees and initial charges against motor vehicles in the expectation of a larger consumption of gasoline, and greater revenue from gasoline taxes, is manifest in the new laws affecting these features that have been passed by the state legislatures.

Studies by the National Highway Users Conference indicate the enactment of reductions in registration fees for passenger vehicles in Arkansas, Idaho, Oregon and Utah, but with this proposal defeated in South Dakota. Similar reductions are provided also for private trucks in Arkansas and Utah, but defeated in South Dakota and West Virginia.

Increases in registration fees and special taxes were enacted for automobiles and private trucks in Montana, and for trucks and buses for hire in Indiana.

A higher gasoline tax of one cent, increasing the charge to five cents a gallon, was passed in Oregon. In Arizona a provision in the existing law which would have automatically reduced the gasoline tax this year by one cent was repealed, and the tax remains at five cents a gallon.

A law providing for the diversion of gasoline taxes was passed in South Dakota in favor of the rural credit bond and interest fund, but such measures calling for diversion for

various purposes were defeated in Indiana, North Dakota and Washington.

New restrictions upon the weight and size of motor vehicles were imposed in several of the states, but defeated in a larger number of states. The length of combination vehicles is reduced from 85 feet to 65 feet in Idaho, and the axle load to 16,000 pounds, but with an increase in the gross permissible load from 40,000 to 50,000 pounds.

Axle loads in New Mexico are reduced to 16,000 pounds unless low pressure pneumatic tires are used, when 18,000 pounds is allowed.

Combination lengths of vehicles in North Dakota are limited to 45 feet and the gross weight to 14,000 pounds; in Oregon to 50 feet, and in South Dakota to 35 feet.

Bills calling for a reduction in combination lengths were defeated, however, in Arizona, Arkansas and West Virginia. In Arizona and Arkansas the permissible length remains at 85 feet, while a proposal in the West Virginia legislature to reduce the combination length to 50 feet failed of passage.

Gasoline Consumption Drops 1.4 Per Cent

NEW YORK—Gasoline consumption for the month of January amounted to 1,081,257,000 gal., as compared with 1,096,667,000 gal. during January, 1932, and 1,126,469,000 gal. in December, 1932, according to

figures recently released by the American Petroleum Institute. This represents a decline from January, 1932, of about 1.4 per cent and from December of about 4.0 per cent.

These figures are based on the quantity of gasoline sold or offered for sale, as reported by wholesalers and dealers in the states, under the provisions of the gasoline tax or inspection laws.

Southworth Heads New York Dealers

NEW YORK—A. G. Southworth, of Glidden Buick, and former Buick branch manager here, has been elected president of the Automobile Merchants Association of New York. Guy O. Simons, Simons-Stewart Co., Chrysler distributor, has been elected first vice-president, and D. C. Fenner, Mack, second vice-president. George Stowe, Reo, continues as secretary and treasurer.

Moto Meter Reduces Loss

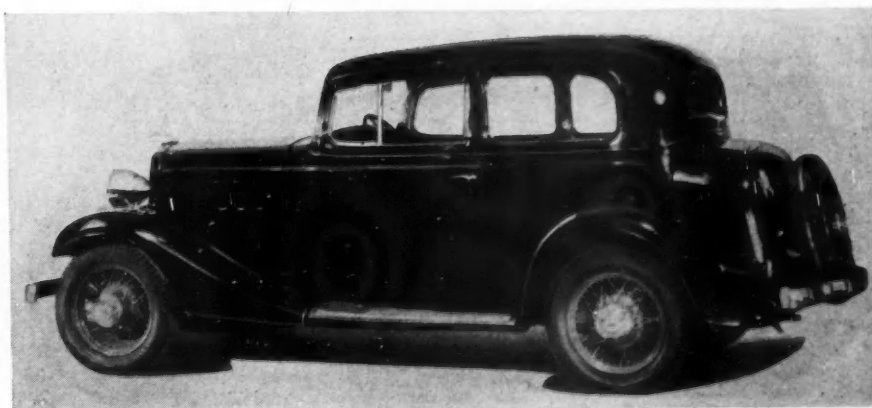
TOLEDO—A net loss of \$369,962 after depreciation, etc., is reported for 1932 by the Moto Meter Gauge & Equipment Corp., as compared with a loss of \$527,048 in 1931. The current position at the year end was as follows:

	1932	1931
Cash	\$ 6,354	\$44,004
Current Assets	642,022	783,295
Current Liabilities	250,681	180,690
Working Capital	391,341	602,605

Graham Appoints Hamlin

DETROIT—Graham-Paige Motors Corp. has announced the appointment of Ralph Hamlin, pioneer automobile racer as Southern California distributor.

Chevrolet Adds New Body



New Chevrolet Master Six town sedan listing at \$545

Chevrolet Batters 1932 First Quarter

Each of First Three Months Register Retail Sales Gains Over '32

DETROIT.—H. J. Klingler, Chevrolet vice-president and general sales manager, has reported that March retail sales exceeded last March and that the last ten days of the month were 5000 new cars and trucks better than the corresponding ten days last year.

Total retail deliveries in March were 34,716 new cars and trucks, compared with 33,125 in March, 1932. For the first quarter of this year, retail sales totaled 106,691 new units, compared with 100,273 in the first quarter of last year, Mr. Klingler announced. He stated that every month this year Chevrolet dealers sold more cars at retail than in the corresponding months of 1932.

Field stocks of new cars dropped 2000 units during the month, and as of the close of March, 42,700 new cars and trucks were divided among the company's 10,000 dealers. Used car stocks remained unchanged, indicating an excellent used as well as new car market, inasmuch as at this season used stocks normally increase.

Administration O.K.'s 30-Hr. Work Week Idea

(Continued from page 472)

If the bill becomes law and is upheld by the courts, there is a considerable automotive opinion that it will mean one of two things: Either the standard of living of workers will be further reduced or wages must be increased thereby raising costs of products without increasing the workers' purchasing power. This is largely because during last 12 months, automotive factories have been reducing numerical employment rather than hours to assure adequate living income for those still employed. Because of this policy, the provisions of

the bill are of immediate interest because average hours are above the 30 hour limit. Consequently unless wage readjustments were effected, labor trouble would not be improbable.

Secretary Perkins indicated that the administration would insist that the embargo on imports made in plants working more than 30 hours, be eliminated and that an exception be made in the case of seasonal industries.

The introduction of amendments to make this law constitutional, as well as laws covering unemployment insurance, is a possibility. The President's telegrams to the governors of 17 industrial states urging passage of minimum wage laws similar to New York's, may be regarded as evidence of the liveness of his interest in social legislation.

N.A.C.C. Members Build 81,370 Units in March

NEW YORK—Production by members of the National Automobile Chamber of Commerce is estimated at 81,370 units, as compared with 93,402 in February, or a decrease of only 13 per cent.

During the first quarter this year 288,634 motor vehicles were produced by the chamber members, reflecting a decrease of 14 per cent under the first three months of last year.

All G.M. Lines Under One Roof

BIRMINGHAM, ALA.—The announcement that the Drennen Motor Car Company, of this city, has been made distributor for Cadillac-LaSalle and Oldsmobile cars gives that company a unique position in the automobile industry in that it now handles all of General Motors cars in one establishment. The addition of Oldsmobile and Cadillac-LaSalle to the Buick, Pontiac and Chevrolet gives Drennen Motor Car Company the whole line.

Metal Market Firmer As Demand Increases

Rise in Automotive Demand for Steel Encourages Growing Feeling of Optimism

NEW YORK.—Fresh encouragement was found by the steel market this week not only in the way automotive business was coming through, but also in the latest unfilled tonnage statement of the leading producer which was made public on Monday afternoon. Although it disclosed a decrease of 13,198 tons in unfilled obligations on March 31, as compared with Feb. 28, analysis revealed this very slight decline to have been solely due to the interruption of bookings during the "bank holiday," the excess of shipments over bookings in March having been a paltry one per cent.

Reports as to activities since April 1 indicate plainly that the market is justified in anticipating an increase in both bookings and shipments for April. Automotive consumers are taking finished steel at a slightly better rate than one out of every four tons produced. The Middle West steel-making districts reported a further stepping up in sheet rolling-operations this week, the rate in the Chicago territory being put at 35 per cent of capacity. Automotive demand for both hot and cold rolled strip steel has broadened.

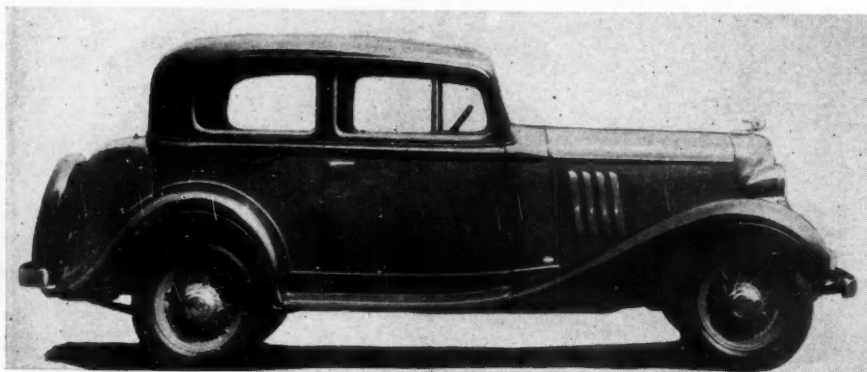
It is one of the significant developments of the prevailing period of retrenchment in fresh capital outlays that appropriations for and installations of improved rolling equipment, especially of modern cold-rolling mills, show a decided uptrend. Bolt and nut manufacturers report better sales to automotive consumers.

Chicago jobbers have superseded the dual base price system for blue annealed sheets with a uniform base price of 2.75 cents, new extras for widths and gage differentials being announced. Mild improvement in alloy steel demand is noted.

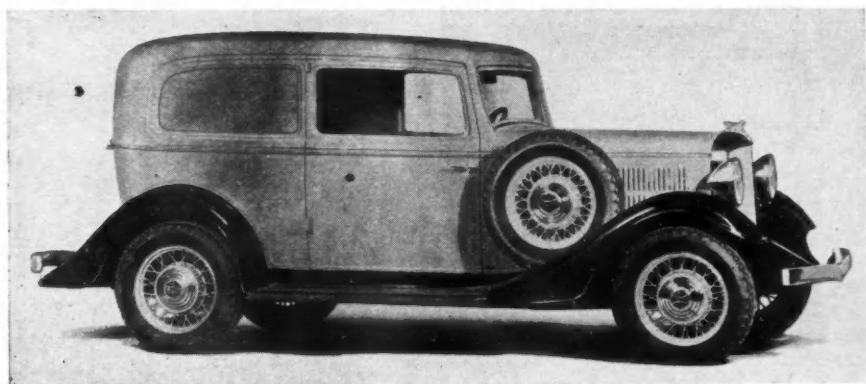
Pig Iron—Somewhat improved demand from automotive foundries is reported by most of the distributing markets. Gradual reduction in stock piles at blast furnaces will, it is thought, bring before long an increase in the number of active stacks. Prices hold steady.

Aluminum—Quiet and unchanged. **Copper**—Simultaneous with reports that a general shut-down of American copper producing companies was impending a \$5 per ton advance was chalked up. Consumers who showed no interest in 5-cent copper, whatsoever, began to sound the market, and early this week there were reports that they had found it rather difficult to cover their requirements at 5½ cents and that a good many holders were trying to get 5½ cents. The shut-down plans appear to be still in the formative stage, the impression in the market being that if the outlook is favorable, the larger producers will make an announcement that they have suspended production and the smaller market factors will then fall in line.

Lead—The leading producer put into effect on Tuesday an advance of \$5 per ton, making the contract price 3¼c, New York. A good deal of their May requirements was covered by storage battery manufacturers at the higher price level. **Zinc**—Further advances have been registered and the New York market is now close to 3½ cents.



Pontiac Touring Sedan Priced at \$675



New Essex Sedan Delivery Car Listing at \$545

Will Build Cars at Chicago Fair

DETROIT—Installation of equipment for the assembly of automobiles at "A Century of Progress Exposition" at Chicago has already been begun by the Chevrolet Motor Company, W. S. Knudsen, president and general manager announced today.

A balcony seven feet above the assembly line, and erected in circular form so that visitors may walk completely around the line and watch every operation in the building of a modern automobile has been provided, Mr. Knudsen said.

Machinery is identical with that used in Chevrolet's eight other assembly plants except that the conventional overhead conveyors will be replaced by floor type conveyors to bring parts to the desired place along the line. Machines will be finished in silver with green trim, and will be manned by about 150 workers in white uniforms.

Production of 25 or 30 cars a day is planned. Two body types—coaches and sedans—will be built on the Master Chevrolet wheelbase. Cars will be driven out under their own power, tested, put through final inspection and may be purchased on the spot and driven home by their new owner.

E. L. Wright has been named manager of the assembly plant by Mr. Knudsen and is to remain in that capacity for the duration of the World's Fair.

Rockne Transfer to South Bend Completed

SOUTH BEND, IND.—Official announcement of the transfer of both Rockne production and sales activities to the Studebaker plants in South Bend was made today by H. S. Vance, Paul G. Hoffman and A. G. Bean. This confirms the report in *Automotive Industries* of April 1 that the move was contemplated.

Rockne April production will be in

South Bend and deliveries on Rockne units will start about April 16. R. A. Vail, formerly in charge of Rockne production in Detroit, is being transferred to South Bend and will be factory manager. R. E. Cole, chief engineer of Rockne, will be located in South Bend and will continue in the same capacity for Rockne.

February Financing Drops Under January

WASHINGTON, D. C.—Retail financing in February declined to 86,804 new and used cars representing a volume of \$29,072,065, as compared with 91,602 cars and \$31,150,193 in January, and 123,574 cars and \$44,829,138 in February, 1932.

Wholesale financing also decreased to \$27,476,782 against \$30,126,590 in January and \$33,276,393 in February of last year.

R.F.C. Lends Detroit Banks \$10,000,000

DETROIT—The R. F. C. has lent \$10,000,000 to the old First National and Guardian banks to enable the conservators to conclude the sale of their assets to the new National Bank of Detroit, the money to be apportioned between the two former banks. Contracts covering the transfer of assets have been approved by the conservators and the new bank, and now await the approval of the federal court. The contracts cover assets amounting to \$131,201,000.

Packard Sales Rebound

DETROIT—Retail deliveries of Packard cars in the last 10 days of March exceeded sales in the previous 20 days by 42 per cent. On April 1, field stocks were less than a third as large as a year previous.

Stutz Working on Rear Engine Car

INDIANAPOLIS—The Stutz Motor Car Co., through its Pak-Age Car division is seriously investigating the field of rear engined passenger cars with extreme streamlined bodies and possibly transmissions of six or seven speeds. The success of the Pak-Age car in tests suggested the possible adaptation to passenger car design.

Col. E. S. Gorrell, president of Stutz, said today that no possibility of production of these cars appeared within a year or more, but plans call for a small car, low and almost tear-drop in streamlining capable of sixty miles an hour or more with fuel consumption being approximately forty miles to the gallon.

The unit assembly of the power plant, transmission and rear axle is planned for the passenger car as in the commercial vehicle. Independent spring also will be used in the new car.

Gorrell pointed out that this activity of the firm has no connection with the production of standard Stutz automobiles and that work in that division of the company will continue independent of the small car experimentation.

William E. Metzger Automotive Pioneer

(Continued from page 473)

vinced him of the future of the automobile and in 1900 he was instrumental in organizing the Northern Motor Car Co. When Cadillac was organized in 1902, Mr. Metzger became sales manager and a director.

In 1908, with the late Walter E. Flanders and B. F. Everett, he organized E. M. F. Subsequently he retired from this company and in 1910 organized the Metzger Motor Co., which was merged into the Maxwell company in 1912. In 1921, he reentered the distribution field as Michigan distributor for Wills Ste. Claire.

He was one of the prime movers in the old Association of Licensed Automobile Manufacturers, the members of which paid royalties under the Selden patent. Previously he had been president for three years of the National Association of Automobile Manufacturers. In 1927, he was named chairman of the National Conference on Municipal Traffic Codes. He was also a past-president of the Detroit Athletic Club and a former fire commissioner of Detroit. At the time of his death he was a member of the S.A.E. and of the Highways Committee of the N.A.C.C.

He was born in Peru, Ill., on Sept. 30, 1868, and hence was in his sixty-fifth year.

40 Yards Now Junk Cars For Cleveland Dealers

CLEVELAND—Agreement has been reached between the Cleveland Auto Wreckers Association and the Cleveland Automobile Manufacturers and Dealers Association to broaden the car scrapping operation. The two organizations have agreed upon a program of cooperation to insure that junker cars are demolished and are not resold as vehicles for use on the highways.

The "highway safety plan" of the National Automobile Chamber of Commerce has been in operation for three years, during which time a scrapping yard approved by the Cleveland car dealers' organization has, under a bonded certificate, agreed to demolish cars turned over to it and has not permitted their resale as vehicles or chassis. The Wreckers' association offered the cooperation of their more than 40 members in extending a certificated demolition plan to include more yards and more cars. Agreement on such a program of cooperation was reached last week.

Ticket Prices Cut

INDIANAPOLIS—Prices on general admission tickets for the Memorial Day 500-Mile Race have been reduced from \$2.50 to \$2.00, and the Speedway will absorb the tax. Tickets are now on sale.

Secy. Roper Gets Cooperation Offer from Highway Users Headed by A. P. Sloan

Swayne Proposes Formation of Committee of Washington Highway Transportation Experts as Point of Contact With Commerce Department

WASHINGTON, D. C.—Alfred P. Sloan, Jr., president of General Motors Corporation and chairman of the National Highway Users Conference, headed a delegation of twelve members of the latter organization who asked Secretary of Commerce Daniel C. Roper that consideration be given to the views of the highway users of the country in working out the government's transportation program. Emphasis was laid upon their assertion that this group represents the shippers' viewpoint as well as that of those who actually operate motor vehicles.

They offered their cooperation in formulating any plan for the coordination of the country's transportation agencies and as evidence of the Conference's attitude reminded the Secretary of agreements reached several weeks ago by the Joint Committee of Railroads and Highway Users. The highway users group, which met with



The front compartment of Packard 12 Formal Sedan is shown at the left. At right is Formal Sedan on a Super 8 Chassis

Packard Formal Sedan



Perfex Names Wilson

MILWAUKEE—R. W. Wilson has been appointed sales manager of the Perfex Corp. Mr. Wilson has been with the company for the past six years in sales and engineering work.

Baldy and Phillips On Pierce Board

BUFFALO—Stockholders of the Pierce-Arrow Motor Car Co. recently elected 12 directors for the coming year. Christopher C. Baldy and George F. Phillips, both of Buffalo, were the only new men named to the board.

Alfred H. Swayne, vice-president of General Motors Corporation, who was chairman of the Joint Committee of Railroads and Highway Users, assured Secretary Roper that the highway users would "place at your disposal all the knowledge and experience which we have through our contact with this problem."

"We hold no brief against any other transportation service," Mr. Swayne said, "nor do we ask for any special privilege. Our sole purpose is to establish a contact so that you may have the benefit of all available knowledge. To that end, should it meet with your approval, we propose to establish a small committee of men resident in Washington who are expert in this field, to be the point of contact for the interests we represent with the work under your supervision. If you feel that you can discuss with us now the problem which faces you and indicate to us how we can best be of service we will have accomplished the purpose of this meeting."

The members of the group calling on Secretary Roper were: Alfred P. Sloan, Jr., chairman, representing the National Automobile Chamber of Commerce; Ernest N. Smith, vice-chairman, representing the American Automobile Association; L. J. Taber, secretary-treasurer, Master of the National Grange; C. B. Ames, president, American Petroleum Institute; Willard T. Chevalier, McGraw-Hill Publishing Company; George E. Clinton, International Association of Milk Dealers; Herbert P. Sheets, president, National Retailers Council; C. O. Sherrill, vice-president, National Chain Stores Association; John A. Simpson, president, National Farmers Union; A. L. Viles, general manager, Rubber Manufacturers Association; Chester H. Gray, American Farm Bureau Federation; Alfred H. Swayne, vice-president, General Motors Corporation; Pyke Johnson, National Automobile Chamber of Commerce; John M. Meighan, National Association of Motor Bus Operators; Fred Brenckman, National Grange; Roy F. Britton, director, National Highway Users Conference.

Hudson Shipments to Gain 60% in April

DETROIT—Chester G. Abbott, general sales manager of Hudson Motor Car Co. has reported an increase of 35 per cent in retail sales of Hudson and Essex cars for the week ending April 1 over the previous week, making the third consecutive weekly increase since the resumption of normal banking operations in most of the important communities throughout the country.

Retail sales are now running two and one-half times those of the week ending March 11, the highest weekly total this year to date, according to Mr. Abbott.

Orders for immediate shipment for the two weeks ending April 15 are 63 per cent higher than shipments for the two weeks ending April 1. For the one week ending April 15 shipments will be 24 per cent higher than the corresponding week of last year.

"Estimated shipments for the en-

tire month of April will exceed March of this year by approximately 60 per cent and will be 40 per cent higher than for the month of April last year," Mr. Abbott further stated.

Case Conference Dates

CLEVELAND—The conference on "Re-Engineering for Economical Manufacture" originally scheduled for March 22-24 at Case School will be held with the original program and speakers beginning on the evening of Wednesday, May 10, continuing through May 12.

Jackson Resigns

PHILADELPHIA—H. W. Jackson has announced his resignation as factory manager and director of the Hess-Bright Manufacturing Co., a division of SKF Industries, Inc. He was connected with Hess-Bright for 18 years.

Wisconsin Motor Corp. is Formed

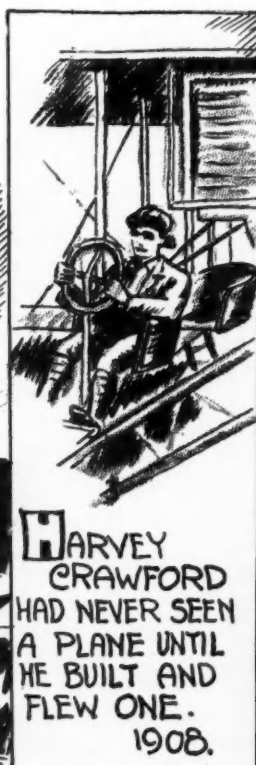
MILWAUKEE—The Wisconsin Motor Corp. has succeeded the Wisconsin Motor Co., following a financial reorganization. The new company, which bought the assets of the old company, has capital of 35,000 shares of \$10 par preferred stock and 52,500 shares of \$1 par common. Of the common, only 17,500 shares have been issued.

Rail Shipment Estimates

WASHINGTON, D. C.—Rail shipments of automobiles, trucks and parts in the second quarter of 1933 are estimated at 54,177 cars by the Regional Shippers' Advisory Boards in their report to the Car Service Division of the American Railway Association. Similar shipments in the corresponding quarter of 1932 were 72,334 cars, or 25.1 per cent greater than the estimate made for the current quarter.

Automotive Oddities—By Pete Keenan

Write us if you know an Oddity



M. L. PULCHER, SOLD AN ORDER OF FEDERAL TRUCKS. ONLY AFTER BECOMING A MEMBER OF THE BUYERS VIENNESE AMATEUR STRING QUARTET.



Dodge Sales Best In Nine Months

DETROIT—Deliveries of Dodge passenger automobiles were greater during the week ending April 1, than in any week since July 18, 1931. Dodge dealers' over-all deliveries—of Dodge and Plymouth passenger cars and Dodge trucks—for the week ending April 1, showed the largest weekly total since June 25, 1932.

Specifically, during the six days covered by the latest report emanating from the office of A. vanDerZee, general sales manager, deliveries of Dodge passenger cars rose 37.3 per cent over the record of the preceding week. Dodge dealers' deliveries of Plymouth models went up 27.2 per cent within the same time. Dodge truck deliveries registered the highest gain, by climbing 53.8 per cent over the figures of the preceding week.

Ford Four Sets New Class C World's Records

PARIS (by mail)—Two Class C world's records were established on Monthlery race track in France during the period March 6-14, with a Ford four-cylinder car entered by the Yacco Oils Co. and driven by six different drivers taking turns. The engine had a bore of 3 $\frac{1}{2}$ and a stroke of 4 $\frac{1}{4}$ in., the piston displacement thus being 200.4 cu. in. The car made 5000 miles in 64 hours 13 minutes 59.71 seconds, corresponding to an average speed of 77.84 m.p.h., and covered 5585 miles, at an average speed of 77.57 m.p.h., in three days. The Ford therefore now holds world's records for 5000 miles in three days. These records are officially listed in Record List No. 195 issued by the Association of Recognized Automobile Clubs on March 22. The list does not say in what respects, if any, the car departed from stock specifications.

Wohlert Corp. Formed

The Wohlert Corp. announces the change of the name of the organization which was formerly the Bates Wohlert Co. Fred Wohlert, Jr., is president and general manager of the new organization, and Walter F. Patenge, formerly of the General Motors Corp., is vice-president and sales manager.

Prof. W. C. Unwin

Prof. W. C. Unwin, an outstanding authority on machine design, hydraulics and other fields of engineering, died on March 17 at the age of 96 years. After some six years' practical experience in mechanical engineering he became instructor in marine engineering at the Royal School of Naval

Architecture, and he later acted as professor of hydraulics and mechanical engineering at the Royal Indian Engineering College and as professor of civil and mechanical engineering at City and Guilds Central Technical College which is now incorporated in the Imperial College of Science, London. Professor Unwin was a very successful teacher and three generations of British engineers were instructed by him. His two-volume work on machine design has long been a classic.

Motor Stocks Gain 6.5% in March

NEW YORK—The market value of automobile and accessory stocks listed on the New York Stock Exchange increased from \$825,307,233 on March 1 to \$880,076,803 on April 1, a gain of 6.5 per cent. The "Motors" fared somewhat better during the month than did stocks generally, as the market value of the entire list showed a gain during March of only one per cent.

CALENDAR OF COMING EVENTS

CONVENTIONS

National Battery Manufacturers Assoc. Louisville, Ky. May 1-2

MEETINGS

National Machine Tool Builders Assoc. Annual Meeting, Cleveland, April 21-25
Natl. Foreign Trade Council, Annual, Pittsburgh April 26-28
U. S. Chamber of Commerce Meeting, Washington, D. C. May 2-5
American Gear Mfg. Assoc., Wilkesburg, Pa. May 4-6
Natl. Automobile Chamber of Commerce, Annual, New York City, June 8
Natl. Retail Hardware Assoc., Indianapolis June 12-16
American Society for Testing Materials, Chicago June 26-30
Automotive Engine Rebuilders Assoc. Annual, Chicago July 10-14
American Chemical Society, Chicago Sept. 11-15
American Transit Assoc., Chicago Sept. 18-20
Natl. Safety Council, Chicago Oct. 2-6
National Metal Congress, Detroit, Oct. 2-6
American Petroleum Institute, Annual, Chicago Oct. 24-26

SECTION MEETINGS—S. A. E.

Baltimore April 20
Buffalo April 18
Canadian April 19
Cleveland April 10
New York (Metropolitan) April 20
New England (Boston) April 12
Northern California April 19
Northwest April 22
Oregon April 21
Philadelphia April 12
Pittsburgh April 25
Southern California April 17
Washington April 19

RACES

Indianapolis Race May 30

G. M.'s First Quarter Sales Ahead of 1932

U. S. Retail Sales Drop Two Per Cent but March Shows 10 Per Cent Gain on Feb.

NEW YORK—Total sales of General Motors dealers here and abroad in the first quarter of 1933 were 199,749 against 197,256 last year, a gain for the three month period of one per cent. Sales to U. S. dealers during the first quarter also ran one per cent ahead of 1932, but sales to U. S. consumers, because of the bank holiday, were two per cent behind last year.

March sales to consumers in the United States amounted to 47,436 and were 12 per cent ahead of February, but three per cent behind March, 1932. March sales to U. S. dealers were 10 per cent behind February and three per cent less than in 1932. Detail figures follow:

SALES TO U. S. CONSUMERS			
	1933	1932	Gain or Loss %
January	50,653	47,942	+ 6
February	42,280	46,855	-10
March	47,436	48,717	- 3
Total, 3 mos.	140,369	143,514	- 2
SALES TO U. S. DEALERS			
January	72,274	65,382	+11
February	50,212	52,539	- 4
March	45,098	48,383	- 7
Total, 3 mos.	167,584	166,304	+ 1
SALES TO U. S., CANADIAN AND OVERSEAS DEALERS			
January	82,117	74,710	+10
February	59,614	62,850	- 5
March	58,018	59,696	- 3
Total, 3 mos.	199,749	197,256	+ 1

Federal's 1932 Report

DETROIT—A net loss of \$631,249 after depreciation and other charges is reported for 1932 by the Federal Motor Truck Co. This compares with a loss of \$461,830 in 1931. At the year end the balance sheet showed:

	1932	1931
Cash and marketable securities...	\$978,358	\$1,131,847
Current assets...	2,708,389	3,381,305
Current liabilities...	166,078	239,664
Working capital...	2,542,311	3,141,641

Ferry Elects North

CLEVELAND—H. D. North has been elected president of the Ferry Cap and Set Screw Co., succeeding the late Thomas Ferry. Mr. North was formerly vice-president in charge of sales. He became associated with the company in 1907 following his graduation from Cornell. E. W. Ferry, son of the late president, was elected vice-president and secretary.

Goodrich Increases Output

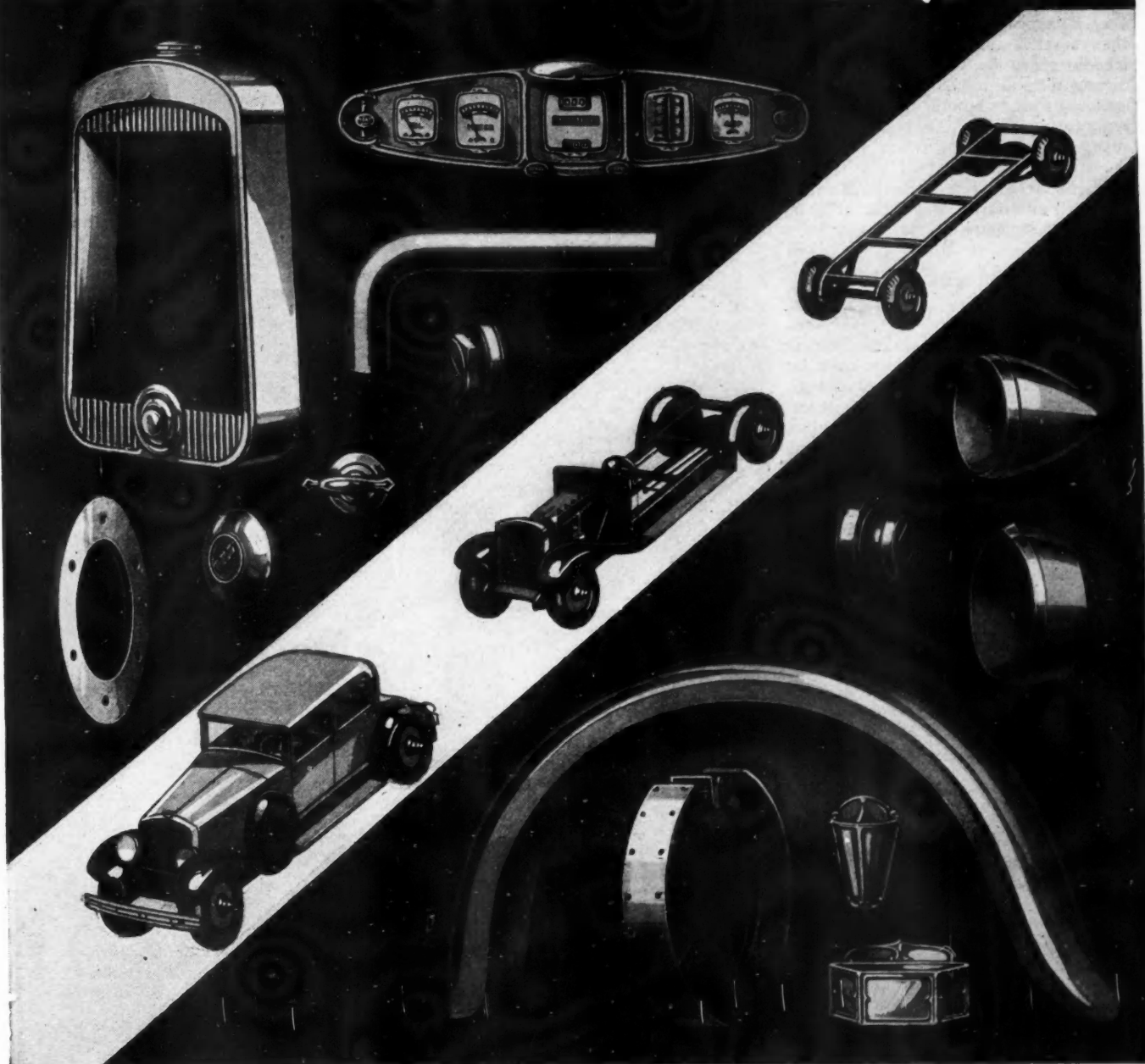
AKRON—A 40 per cent increase in tire production became effective April 1 in the Akron, Ohio, factories of the B. F. Goodrich Co., J. D. Tew, president, announces.

American
QUALITY
Steel & Wire Company

COLD ROLLED STRIP STEEL

THE Automotive Industry—always quick to grasp methods concerning efficient production and lowering costs—accepted American Quality Cold Rolled Strip Steel as a great step forward. Its ease of fabrication—its adaptability to every type of drawing, stamping and forming—brought on economies and won consumer good will through high quality. In your own case—it may be more practical for you to use American Quality Cold Rolled Strip Steel than some more expensive material, or in place of castings. To help you secure the facts—the entire resources of our engineering and manufacturing divisions are placed unreservedly at your disposal. Write us about your requirements.

EFFICIENT PRODUCTION-PLUS HIGH QUALITY



1831



1933

AMERICAN STEEL & WIRE COMPANY

208 South LaSalle Street, Chicago
94 Grove Street, Worcester

SUBSIDIARY OF UNITED STATES STEEL CORPORATION

Empire State Bldg., New York
First National Bank Bldg., Baltimore

AND ALL PRINCIPAL CITIES

Pacific Coast Distributors: Columbia Steel Company, Ross Building, San Francisco

Export Distributors: United States Steel Products Company, New York

NEW DEVELOPMENTS

Automotive Parts, Accessories and Production Tools

Needle File Has Knurled Handle

The American Swiss File & Tool Co., Elizabeth, N. J., has placed on the market an improved line of Needle Files having a knurled handle or tang in place of the old style smooth round handle or tang. The knurling prevents slippage and assures a firm grip without cramping the fingers and hand of the user.

These Needle Files are made in all the regular shapes and sizes at a no higher price than the old style.

Drills 240 Holes in 60 Crankshafts per Hour

An automatic, continuous cycle crankshaft drilling machine of the double index type has been placed on the market by the Davis & Thompson Company, Milwaukee, Wis. It handles 22 shafts at a time, with a production of 60 per hour, a total of 240 holes 3/16 in. diameter, 5 1/4 in. long.

The machine is entirely automatic in its action. The drilling is done by the step method utilizing Vickers Units. The indexing is accomplished

two crankshafts and replaces them each time the machine indexes. The crankshafts are loaded and unloaded at the front end of machine.

The machine is equipped with four drill heads, each one being driven by its individual motor. Each head carries two drills, each one of the drills drilling a separate crankshaft. The shafts are rotated to bring the proper pins into the correct position to drill by gears engaging in a stationary rack at the proper time.

After the crankshaft is drilled the fixture passes off the rack and is prevented from turning by ball bearings which serve as rollers as shown on front right side of machine shown on photo. The rollers located in the center of links carry the crankshafts on the return.

Spark Plug Compensates Expansion Differences

A new spark plug for motorcycle engines has been developed by the AC Spark Plug Company. The plug has an elastic two-piece assembly designed to compensate for differences



New AC Motorcycle Spark Plug

in heat expansion between shell and insulator. It is said to be able to stand the highest engine temperatures without causing preignition or gas leakage.

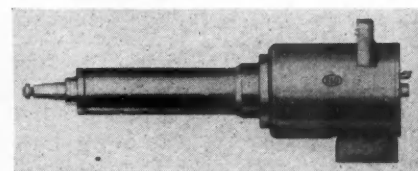
Better Finish With Balanced Grinder Unit

Ex-Cell-O Aircraft & Tool Corp., Detroit, Mich., announces a new in-built balanced motor driven grinding spindle designed for the No. 3 Abrasive surface grinder. The rotor of the electric driving motor is mounted directly on the spindle shaft, thereby eliminating couplings or similar meth-

ods of drive between motor and spindle. The motor field is mounted in the opposite end of the spindle, forming a compact and rigid unit. The electric motor is of one horsepower capacity, and can be furnished for 220, 440 or 550 volt, three phase, 50 or 60 cycle operation.

The grinding spindle portion of this unit has the same standard construction as all Ex-Cell-O spindles with the Ex-Cell-O precision ball bearings throughout except on the outer end of the motor where an Oil-less bearing is used.

This spindle unit eliminates belts and pulleys, thus reducing vibration to a minimum.



Inbuilt Grinding Spindle for Ex-Cell-O Abrasive Surface Grinder

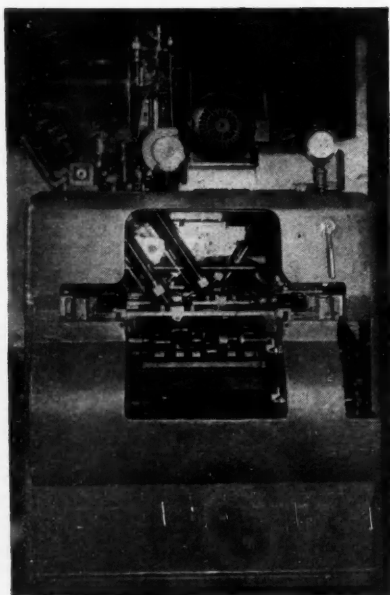
Rubber Prisms Dampen Recoil

A new feature has been introduced in the design of the General Rubber Company's Dual Balloon tire and the Streamline Jumbo tire, that of prismatic side wall construction. As may be seen from the illustration herewith, there are a number of concentric circles of rubber prisms on the side walls, while the inner section of the side wall gives a moire silk effect. The rubber prisms are not only



New General Streamline Jumbo Tire

intended to add to the appearance of the tires but also to produce a damping effect, preventing excessive recoil after the tire has struck a bump in the road. In other respects the tires remain identical with last year's design.



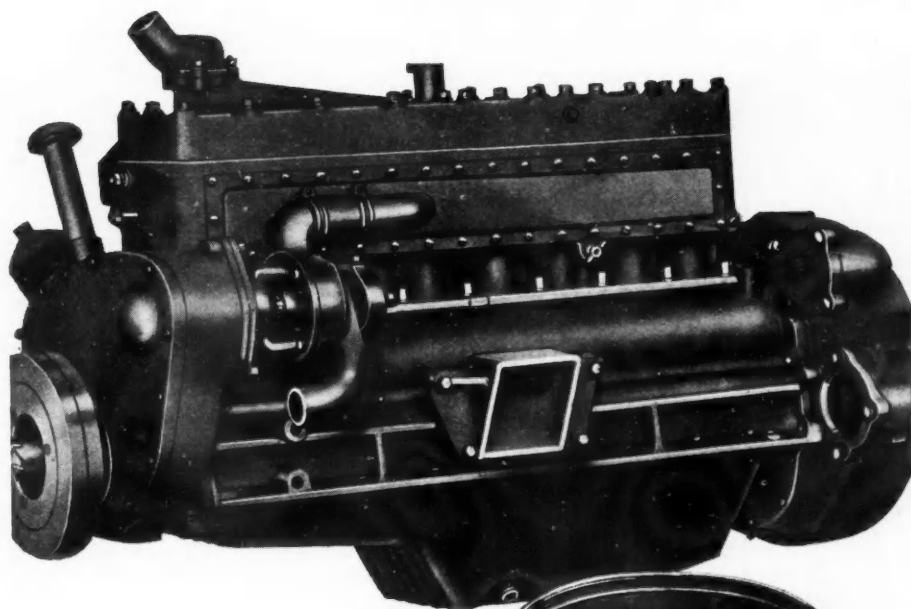
Davis & Thompson Automatic Crankshaft Driller

with hydraulic cylinders. As soon as the indexing is completed the drilling starts. While the drilling operation is in progress the operator removes

FOR HEAVY DUTY SERVICE

POWERED *by* LYCOMING

MEANS CYLINDER BLOCKS OF
NICKEL CAST IRON



● Series H F engine built by the Lycoming Manufacturing Company, Williamsport, Pa. Cylinder block made of Nickel Cast Iron, produced in Lycoming's foundry.



NICKEL CAST IRON



● Close-up of 8 cylinder, Nickel Cast Iron block used in H F series engine pictured above. Product of the Lycoming foundry at Williamsport.

IN designing a special straight 8 for truck service, Lycoming engineers selected a special grade of nickel chromium cast iron for its cylinder blocks because they knew that this is the *longest wearing cylinder block material known today*. By using the improved alloyed cast iron, Lycoming assures to the many users of its high grade motors a long life of uninterrupted service.

The addition of Nickel produces castings that are close-grained, free from porous and hard spots, and of high, uniform hardness in both thick and thin sections.

These properties give a tough, wear-resisting surface, yet render machining exceptionally easy. They also help to hold down costly rejections.

Every year sees an increase in the number of leading manufacturers who are turning to Nickel Cast Iron cylinder material. It adds hundreds of miles to the life of engines. It saves money in machine shop operations. Let us discuss your foundry problems with you. Our specialists are at your service.

THE INTERNATIONAL NICKEL COMPANY, INC.

Miners, refiners and rollers of Nickel.
Sole producers of Monel Metal.

67 Wall Street

New York, N. Y.

AUTOMOTIVE INDUSTRIES

Through Tests of Reader In

During past years many tests have been made to determine the relative standing with their readers of publications reaching those in automotive manufacturing plants. The results have been the same. **AUTOMOTIVE INDUSTRIES** leads. A prominent manufacturer has recently made another such test. The results are given below. In this test approximately 850 of the principal engineers, production men, general executives, purchasing agents, service managers, sales managers, and others, in 55 leading automotive manufacturing plants were questioned. Of these 292 replied.

Analysis of Replies

Showing Number Receiving Each Publication

Publication	Number Receiving
AUTOMOTIVE INDUSTRIES	238
A Technical Society Journal	186
An Automotive Daily	182
Another Automotive Weekly	167

Preference Analysis on Point Basis

For First Preference—4 points, for Second Preference—3 points,
for Third Preference—2 points, for Fourth Preference—1 point.
Where 2 or more publications were checked and no preference
shown, the points were divided accordingly.

Publication	Points Received
AUTOMOTIVE INDUSTRIES	771
An Automotive Daily	549½
A Technical Society Journal	474
Another Automotive Weekly	454½

AUTOMOTIVE INDUSTRIES Has Automotive Publication Among Automotive Manufacturing

●

AUTOMOTIVE

A Chilton Publication - Chestnut &

Proves Its LEADERSHIP Interest In Automotive Plants

In another case, a New York advertising agency mailed 1000 questionnaires to the principal engineers, production men, general executives, purchasing agents, service managers, sales managers, and others in 100 leading automotive manufacturing companies. 364 replies were received.

The questionnaire read: "Please check the publication in the following group that you read with most regularity and interest."

Analysis of Replies From Those Voting for One Publication Only

Publication	Preferred by
AUTOMOTIVE INDUSTRIES	92
An Automotive Daily	39
Another Automotive Weekly	20
A Technical Society Journal	20

The vote for AUTOMOTIVE INDUSTRIES exclusively was approximately 2½ times that for the next publication.

The remainder of those replying voted for more than one publication.

151 voted for combinations of publications *including* AUTOMOTIVE INDUSTRIES

30 voted for combinations of publications *not including* AUTOMOTIVE INDUSTRIES

And that's a ratio of 5 to 1 in favor of AUTOMOTIVE INDUSTRIES

KNOWING the leading publication for your automotive advertising is important today!

The Biggest Circulation of Any Men Directly Connected With In All Its Phases

INDUSTRIES
56th Streets, Philadelphia, Pa.

EXPANSION PLUGS

FOR CLOSING CORE HOLES

COILED and FLAT SPRINGS

PHOSPHOR BRONZE SPRINGS A SPECIALTY

SMALL STAMPINGS

WASHERS and SPRING COTTERS

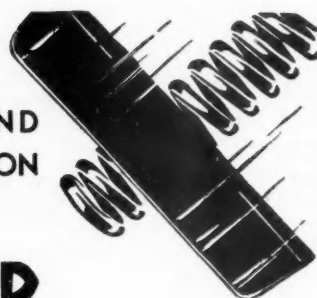
WIRE SHAPES**M. D. HUBBARD SPRING CO.**

620 SOUTH BLVD.

PONTIAC, MICHIGAN

IN AUTOMOTIVE AND
AIRPLANE CONSTRUCTION

specify

**RAYMOND
SPRINGS**for dimensional accuracy and long life
RAYMOND MFG. CO., CORRY, PA.

Greenlee
BROS. & CO. 
ROCKFORD, ILLINOIS, U.S.A.
MULTIPLE SPINDLE DRILLING AND TAPPING MACHINES.
AUTOMATIC SCREW MACHINES. SPECIAL MACHINERY

FELT**AMERICAN FELT CO.**

NEW YORK

DETROIT

CHICAGO

BUYERS' GUIDE**Automotive Products and Factory Equipment Manufactured by Advertisers in This Issue**

See Alphabetical List of Advertisers on Page 40

This Advertiser's Index is published as a convenience, and not as part of the advertising contract. Every care will be taken to index correctly. No allowance will be made for errors or failure to insert.

Alloys	Bushings	Enamels	Hammers	Nickel
<i>Ferro</i>	<i>Fibre</i>	American Chemical Paint Co. (Rust Proofing)	<i>Power</i>	International Nickel Co.
International Nickel Co.	Continental-Diamond Fibre Co.		Chambersburg Engineering Co.	
<i>Non-Ferrous</i>		Felt	Chambersburg National Co.	Pads
International Nickel Co.	Cable	American Felt Co.	National Machinery Co.	<i>Felt</i>
	<i>Brake or Cut-Out Control</i>	Fibre Rods, Sheets, Tubes	Heaters, Car	American Felt Co.
Axles	American Steel & Wire Co.	Continental-Diamond Fibre Co.	Stewart-Warner Corp.	
Park Drop Forge Co.	<i>Ignition, Starting and Lighting</i>	Forgings		Paints
	American Steel & Wire Co.	Park Drop Forge Co.	Heat Treating	<i>Heat Resisting</i>
Bending & Straightening Machines		Furnaces, Electric	Barnes Co., Wallace	American Chemical Paint Co.
Chambersburg Engineering Co.	Channels for Glass	(Annealing, Carburizing, Heat Treating, Forging and Welding)	Gibson Co., Wm. D.	
Chambersburg National Co.	<i>Felt</i>	Electric Furnace Co.	Hose, Flexible Metallic (Radiator and Fuel Lines)	Picking Compounds
National Machinery Co.	American Felt Co.		Titeflex Metal Hose Co.	American Chemical Paint Co.
Boring Machines		Gaskets	Insulating Material	Plugs
Foote-Burt Co.	Cleaners	<i>Felt</i>	Continental-Diamond Fibre Co.	<i>Expansion</i>
	<i>Metal</i>	American Felt Co.		Hubbard Spring Co., M. D.
Brake Drums	American Chemical Paint Co. (Rust Preventive)	Gear Material	Lathes	
Motor Wheel Corp.		<i>Non-Metallic</i>	<i>Automatic Chucking</i>	Presses
Brakes	Crankshafts	Continental-Diamond Fibre Co.	Potter & Johnston Machine Co.	Chambersburg Engineering Co.
<i>Mechanical</i>	Park Drop Forge Co.		<i>Turret</i>	Chambersburg National Co.
Stewart-Warner Corp.		Gears	Potter & Johnston Machine Co.	National Machinery Co.
<i>Power</i>	Drilling Machines	<i>Timing, Non-Metallic</i>	Molded or Machined Parts (Phenolic)	Removers, Enamel and Paint
Stewart-Warner Corp.	Foote-Burt Co.	Continental-Diamond Fibre Co.	Continental-Diamond Fibre Co.	American Chemical Paint Co.
Bumpers	Greenlee Bros. & Co. (Multiple Spindle)			
Stewart-Warner Corp.				

April 15, 1933

Automotive Industries

CHAMBERSBURG-NATIONAL

COMPLETE FORGING EQUIPMENT

CHAMBERSBURG
ENGINEERING CO.
CHAMBERSBURG, PA.THE NATIONAL
MACHINERY CO.
TIFFIN, OHIOSales Offices
NEW YORK, 152 W. 42nd St. CHICAGO, 565 W. Washington St.
DETROIT, 2457 Woodward Ave.**Pioneers in Better Drilling Methods**Single and multiple spindle special drilling, boring, reaming, tapping machine and FOOTBURT Sipp Sensitive Drilling Machines
THE FOOTE-BURT COMPANY CLEVELAND, OHIO**CRANKSHAFTS**
and
Heavy Drop ForgingsTHE PARK DROP FORGE CO.
CLEVELAND, OHIO**DIAMOND** Vulcanized
FibreSheets, rods, tubes, washers and special shapes, to meet every insulating need
Also CELORON Timing Gears and DILECTO.
CONTINENTAL-DIAMOND FIBRE CO.
Newark, Delaware**STAMPINGS**

Heavy, medium and light stampings in any quantity. A steady flow of production—when you want it.

WORCESTER STAMPED METAL CO
Worcester, Mass.**ELECTRIC AND FUEL FIRED FURNACES**
ELECTRIC FURNACE CO.
SEND FOR BULLETINS
SALEM OHIO**DEOXIDINE—**
Prepares Auto Bodies for Painting**RODINE—**
Pickling Bath Control**STRIPPLE**
High Speed Enamel Remover**PEROLINE—**
Rust Preventing Oil**KEMICK—**
Manifold Paint**FLOSOL—**
Soldering Flux**PARADOX—**
Rust Proofing Enamel**AMERICAN CHEMICAL PAINT CO.**
AMBLER, PENNA.*A*UTOMOTIVE INDUSTRIES is read each week by general executives, production men, engineers, purchasing agents and others whose o.k. means orders for those who sell to The World's Largest Manufacturing Industry.**BUYERS' GUIDE—Continued****Rust Removers & Preventives**

American Chemical Paint Co.

Screw Machine Products

Barnes Co., Wallace

Screw MachinesGreenlee Bros. & Co.
Potter & Johnston Machine Co.**Shafts, Axle, Propeller & Transmission**

Pittsburgh Steel Co.

Shock Absorbers

Stewart-Warner Corp.

Special Machinery

Greenlee Bros. & Co.

Speedometers and Tachometers

Stewart-Warner Corp.

Springs

Extension, Compression, Torsion or Flat

American Steel & Wire Co.

Barnes Co., Wallace
Barnes-Gibson-Raymond, Inc.
Cook Spring Co.
Gibson Co., Wm. D.
Hubbard Spring Co., M. D.
Raymond Mfg. Co.**Valve**

American Steel & Wire Co.

Stampings or Drawings, MetalBarnes Co., Wallace
Barnes-Gibson-Raymond, Inc.
Cook Spring Co.
Gibson Co., Wm. D.
Hubbard Spring Co., M. D.
Motor Wheel Corp.
Raymond Mfg. Co.
Worcester Stamped Metal Co.**Steam Cooling**

Rushmore Laboratory

Steel**Alloys**Illinois Steel Co.
Republic Steel Corp.**Bars**Illinois Steel Co.
Republic Steel Corp.**Billets**

Illinois Steel Co.

CarbonIllinois Steel Co.
Republic Steel Corp.**Cold Drawn**American Steel & Wire Co.
Republic Steel Corp.**Electric Furnace**

Illinois Steel Co.

Shapes

Illinois Steel Co.

SpringBarnes Co., Wallace
Barnes-Gibson-Raymond, Inc.
Gibson Co., Wm. D.**Stainless**Illinois Steel Co.
Republic Steel Corp.**Strip**American Steel & Wire Co.
Illinois Steel Co.
Republic Steel Corp.**Tapping Machines**Foote-Burt Co.
Greenlee Bros. & Co.**Tubes, Axle, Steering Column & Torque**

Pittsburgh Steel Co.

TubingFlexible Metal
Titeflex Metal Hose Co.**Seamless**

Pittsburgh Steel Co.

Steel

Pittsburgh Steel Co.

Tubular Products

Pittsburgh Steel Co.

Turret Machines, Automatic

Potter & Johnston Machine Co.

Vacuum Tanks

Stewart-Warner Corp.

WashersFelt
American Felt Co.**Plain Metal**

Hubbard Spring Co., M. D.

Welding Material

American Steel & Wire Co. (Wires and Electrodes)

Wheels

Motor Wheel Corp.

Wicks, Felt

American Felt Co.

Windshield Wipers

Stewart-Warner Corp.

Wire

Flat, Round, Square or Special Shape

Barnes Co., Wallace

SpringAmerican Steel & Wire Co.
Barnes Co., Wallace
Pittsburgh Steel Co.
Republic Steel Corp.



When roads grow rough
It takes good alloy to stand the punishment

ILLINOIS *alloy* STEEL
ALWAYS DEPENDABLE

Dependability in Illinois Alloy Steel is assured
through careful control of production plus rigid
inspection of every heat

Illinois Steel Company
SUBSIDIARY OF UNITED STATES STEEL CORPORATION
308 South La Salle Street, Chicago, Illinois



PJ FOR OVER **PJ**
A QUARTER OF
A CENTURY
THE PIONEER
MANUFACTURER OF
AUTOMATIC CHUCKING
EQUIPMENT

POTTER & JOHNSTON MACH. CO.
PAWTUCKET, R. I., U. S. A.

10 to 20 percent
SAVING IN FUEL
WITH
Steam Cooling
Rushmore Laboratory
PLAINFIELD • NEW JERSEY

April 15, 1933

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The Advertisers' Index is published as a convenience, and not as a part of the Advertising contract. Every care will be taken to index correctly. No allowance will be made for errors or failure to insert.

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Automotive Industries



Wheels that harmonize

"JUST ANY WHEEL," WON'T DO

With body trends toward lower lines, more generous fenders and larger section tires, wheels are occupying a more important place in motor car design than ever before.

Motor Wheel has long championed the idea that wheels should blend harmoniously into the car's style design rather than serve merely as rolling devices. The new Demountable Wood Wheel, by Motor



Wheel, carries out the appearance of mass to match body lines, yet imposes no additional unsprung weight. Wood wheels offer a degree of strength that is unmatched by any wheel type, pound for pound of weight.

And Wood Wheels lend themselves to artistic paint effects that render them truly integral parts of the car as the eye sees it, not apparent additions to it.

MOTOR WHEEL CORPORATION
Lansing, Michigan

Manufacturers of Demountable Wood, Steel and Wire Wheels . . . Forged Spoksteel Truck, Bus and Trailer Wheels . . . Industrial Stampings . . . Sole Producers of Centrifuge Brake Drums

OFTEN IN YOUR HAND . . . BUT NEVER IN YOUR MIND

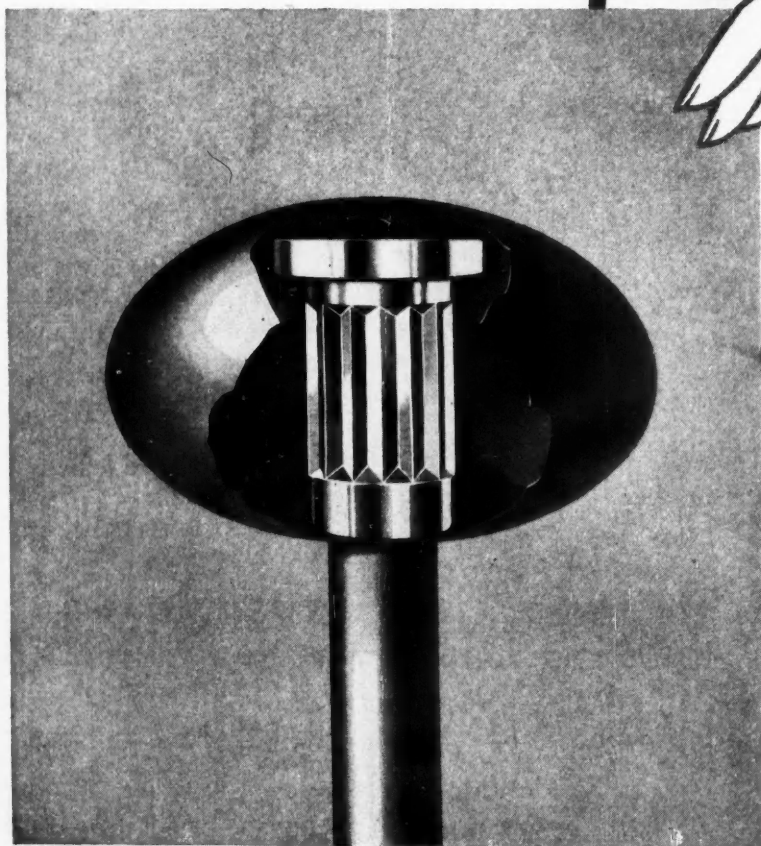
Hidden inside the ball that tops the gear shift lever of your car is a little piece of metal—out of sight—out of mind—but performing a vital function every time you shift gears.

Upson has produced millions of these inserts for many car manufacturers since the development of a faster, more economical and better process than the screw machine method. Heads are upset, the fluted section is rolled in and the inside

bored and tapped at a speed that has made possible worth while savings in cost.

The same engineering skill that made this and countless other automotive headed and threaded parts economically possible is at your service whenever a problem of design, or production, or cost presents itself—old or new parts made better, faster and cheaper through Upson's accumulated experience and unsurpassed manufacturing facilities. Send us your inquiries.

Bolts and nuts in all standard and special shapes, sizes, alloys and finishes. Standard and special rivets of all kinds. Wire rope clips. Turnbuckles. Belt fasteners. Automotive and railroad special items. Headed and threaded products for every use. Your specialties are our specialty.



UPSON NUT DIVISION

**REPUBLIC STEEL
CORPORATION**

CLEVELAND, OHIO

